RFU65x

RFID read/write device (UHF)

SICK
Sensor Intelligence.

Described product

RFU650-101xx

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

Original document

This document is an original document of SICK AG.

Declarations of conformity and certificates

Due to the country-specific approvals for the device in the form of country variants, the respective conformities are type-dependent.

For the current device see:

- Technical Information RFU65x Regulatory Compliance Information

A printed copy of the Technical Information is enclosed with the device at the time of delivery.

ⓘ **NOTE**
You will find the Technical Information RFU65x Regulatory Compliance Information, declarations of conformity and certificates on the product page.
The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
{P/N} corresponds to the part number of the product, see type label.
{S/N} corresponds to the serial number of the product, see type label (if indicated).

The type designation of your product (e.g. device) can be found on the type label.

If the device is installed in a difficult to access part of the plant, note the device type, and the part number and serial number of the device.

UL certificate valid for tested USA country variants, see type label of the present device.

Contents

CONTENTS

1 About this document

1.1 Information on the operating instructions

These operating instructions provide important information on how to use devices from SICK AG.

Prerequisites for safe work are:

*   Compliance with all safety notes and handling instructions supplied.
*   Compliance with local work safety regulations and general safety regulations for device applications

The operating instructions are intended to be used by qualified personnel and electrical specialists.

> **NOTE**
> Read these operating instructions carefully to familiarize yourself with the device and its functions before commencing any work.

The operating instructions are an integral part of the product. Store the instructions in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the device is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Related applicable documents

Document	Title	Part number	Source
Notes	Safety Notes	8024992	Printed version is enclosed with the device at delivery
Technical Information	RFU65x Regulatory Compliance Information	8026893	www.sick.com/8026893
Technical Information	RFU Parameter Description	8023085	www.sick.com/8023085

1.3 Scope

Documentation concept

The documentation concept for the device includes the following publications:

*   Safety Notes (part no. 8024992)
*   Technical Information RFU65x Regulatory Compliance Information (part no. 8026893)
*   RFU65x operating instructions
*   RFU parameter description

The publications are valid for all available product types (country variants of the device).

More detailed information for identification of the available device type . The type designation of your device can be found on the type label.

> **NOTE**
> You will find the Technical Information RFU65x Compliance Information, the RFU65x operating instructions as well as the declarations of conformity and certificates on the product page.
>
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
>
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Function of the publications:

The Safety Notes provide information about:
- Safe handling of the device
- Online access to the operating instructions and other documentation

The Technical Information RFU65x Regulatory Compliance Information lists:
- Regionally-approved country variants of the RFU650-101xx (xx = region assignment)
- Existing radio equipment approvals and conformities
- Any country-specific operating conditions for the devices that need to be observed

> **NOTE**
> A printed copy of the Safety Notes and the Technical Information RFU65x Regulatory Compliance Information are enclosed with the device.

RFU65x operating instructions
- The purpose of the operating instructions is to enable you to integrate the device into a customer system and to achieve initial read results with transponders.
- The operating instructions provide step-by-step instructions for all tasks associated with installing and operating the device.
- The operating instructions describe the commissioning process for an application with a single device.
- Commissioning is based on the default setting of the device parameters. A simple use case is the reading of a single transponder on an object.
- In the operating instructions, the RFU65x RFID read/write device is referred to simplified as "device".
- If variants need to be differentiated in regard to their region assignment, the relevant device name RFU650-101xx is specified (xx = region assignment).
- The terms "transponder" and "tag" for the electronic data media are interchangeable. The term "transponder" is used in these instructions.
- The appendix of these operating instructions contains electrical wiring diagrams. The diagrams apply to the optional CDB650-204 and CDM420-0006 connection modules when used in conjunction with this device.
- Functions specific to special devices are, where necessary, described in additional documents.

1.4   Explanation of symbols

Warnings and important information in this document are labeled with symbols. Signal words introduce the instructions and indicate the extent of the hazard. To avoid accidents, damage, and personal injury, always comply with the instructions and act carefully.

> ⚠ **DANGER**
> ... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING
... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION
... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTICE
... indicates a potentially harmful situation, which may lead to material damage if not prevented.

NOTE
... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

1.5 Further information

More information can be found on the product page.

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{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

The following information is available depending on the product:
• Data sheets
• This document in all available language versions
• CAD files and dimensional drawings
• Certificates (e.g., declaration of conformity)
• Other publications
• Software
• Accessories

For RFU65x:
• Technical Information RFU65x Regulatory Compliance Information
• RFU parameter description.
  The parameter description helps when configuring applications using the SOPAS ET configuration software.

2 Safety information

2.1 Intended use

The RFU65x RFID read/write device is a compact, intelligent 4Dpro sensor from the RFU6xx (UHF) product family. Version (working range): Long Range

The device is used for the automated, fixed identification of wireless-based data cards (transponders) on moving or stationary objects, and for the management of these data cards.

The RFU650 base unit processes the data of all standard passive transponders in accordance with ISO/IEC 18000-63 and EPCglobal UHF C1G2 in the regional UHF carrier frequency range.

The device contains an (internal) antenna integrated into the housing. Besides detection of the transponders, the antenna can also recognize the passage and direction of moving transponders.

Thanks to its intelligent process logic, the device operates either in stand-alone operation or as part of a group with several devices in a CAN network. The device sends the read results to a higher-level computer (e.g., PLC) via its host interface for further centralized processing. The protocols integrated into the device provide access to standard fieldbus technology.

The device allows operation within a wide ambient temperature range. Details see "Ambient data", page 78 in the technical data.

The device is primarily designed for use in industrial and logistics areas. The device meets the applicable requirements for industrial robustness, interfaces and data processing. If necessary, the device can be programmed to implement customer-specific modifications.

Variants:
- Country variants of the device refer to the radio-technical region assignment, see Technical Information RFU65x Regulatory Compliance Information.

ⓘ **NOTE**
The USB interface of the device is used in industrial environments only as a service interface for temporary use (e.g. for configuration, troubleshooting). Use as a host interface while the system is in operation is not supported.

Intended use of the device also includes compliance with all information in:
- Safety Notes
- Technical Information RFU65x Regulatory Compliance Information
- RFU65x operating instructions

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is not described in this documentation.

2.1.1 Operational restrictions

The region assignment of the device is configured for the specific type when delivered and cannot be changed. This enables the device to be operated in the approved region without interfering with national protected frequencies (e.g., mobile communications).

Operating the same device in another region for which there is no approval is prohibited.

A region consists either of a group of countries or one country.

NOTE

The device approval was granted for a specific region. The region assignment cannot be changed.

- Use the device only in the region and country for which the device is approved.
- Observe country-specific operating conditions for the device, see Technical Information RFU65x Regulatory Compliance Information.
- When reselling the device, inform the buyer of the fixed region assignment.
- When passing the device on to third parties, also include the Safety Notes, the Technical Information RFU65x Regulatory Compliance Information and the RFU65x operating instructions.
- A printed copy of the Safety Notes and the Technical Information Regulatory Compliance Information are enclosed with the device.

NOTE

You will find the Technical Information RFU65x Regulatory Compliance Information, the RFU65x operating instructions as well as the declarations of conformity and certificates on the product page.

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2.1.2 Regulatory notes

See Technical Information RFU65x Regulatory Compliance Information (part no. 8026893).

2.1.3 Conditions for specified enclosure rating

To ensure compliance with the specified IP67 enclosure rating of the device during operation, the following requirements must be met: If these requirements are not met, the device does not fulfill any specified enclosure rating.

- The shared side cover of the USB interface and card slot must be screwed tight to the device. Recommended tightening torque for the cover screws: 40 Ncm ± 5 Ncm.
- The heads of the connecting cables plugged into the M12 electrical connections must be screwed tight.
- Any unused electrical M12 connections must be fitted with protective elements, e.g., protective caps (as delivered). The protective elements are hand-tightened.

The same also applies to the EMC requirement (ESD) according to CE.

Positions of the individual elements

2.1.3.1 Exception: temporarily opening the cover on the device

NOTICE

Risk of damage to the product when the cover is open

When the cover is open, the device does not conform to a specified enclosure rating.

If necessary, only operate the device for a short time with an open cover for the activities listed in the following: During this time, protect the device against moisture and dust.

Temporarily open the cover for the following activities:

- Insert or remove the optional storage medium (SD card)
- Temporary use of the USB interface as a service interface

For this purpose, open the corresponding side cover on the device. After completing this task, close the cover again.

For further warranty provisions, see the General Terms and Conditions of SICK AG, e.g. on the delivery note of the device.

2.2 Improper use

Any use outside of the stated areas, in particular use outside of the technical specifications and the requirements for intended use, will be deemed to be incorrect use.

- The device does not constitute a safety component in accordance with the respective applicable safety standards for machines.
- The device must not be used in explosion-hazardous areas, in corrosive environments or under extreme environmental conditions.
- Any use of accessories not specifically approved by SICK AG is at your own risk.

⚠️ **WARNING**
Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe the following information:

- Product should be used only in accordance with its intended use.
- All information in the documentation must be strictly observed.
- Shut down the product immediately in case of damage.

2.3 Cybersecurity

Overview

To protect against cybersecurity threats, it is necessary to continuously monitor and maintain a comprehensive cybersecurity concept. A suitable concept consists of organizational, technical, procedural, electronic, and physical levels of defense and considers suitable measures for different types of risks. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

You will find further information at www.sick.com/psirt, e.g.:
- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

2.4 Limitation of liability

Relevant standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when compiling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Non-adherence to the product documentation (e.g., operating instructions)
- Incorrect use
- Use of untrained staff
- Unauthorized conversions or repair
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

> **(i) NOTE**
>
> The product is a programmable device. The respective programmer is therefore responsible for his/her programming work and the resultant operation of the device. The liability and warranty of SICK AG is limited to the device specification (hardware functionality and any programming interfaces) according to the agreed conditions. SICK AG will therefore not be liable, among other things, for any damages resulting from the programming of the product by the customer or third parties.

2.5 Modifications and conversions

> **(!) NOTICE**
>
> Modifications and conversions to the device may result in unforeseeable dangers.

Interrupting or modifying the device or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation.

2.6 Requirements for skilled persons and operating personnel

> **⚠ WARNING**
>
> **Risk of injury due to insufficient training.**
>
> Improper handling of the device may result in considerable personal injury and material damage.
>
> - All work must only ever be carried out by the stipulated persons.

The following qualifications are required for various activities:

Table 1: Activities and technical requirements

Activities	Qualification
Mounting, maintenance	- Basic practical technical training - Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	- Practical electrical training - Knowledge of current electrical safety regulations - Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	- Basic knowledge of the computer operating system used - Basic knowledge of the design and setup of the described connections and interfaces - Basic knowledge of data transmission - Basic knowledge of RFID technology (identification with radio-based data cards) - Knowledge of the programming of devices
Operation of the device for the particular application	- Knowledge of the operation and control of the devices in their particular application - Knowledge of the software and hardware environment for the particular application

2.7 Operational safety and specific hazards

Please observe the safety notes and the warnings listed here and in other sections of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.

WARNING
Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- The power supply must be disconnected when attaching and detaching electrical connections.
- The product must only be connected to a voltage supply as set out in the requirements in the operating instructions.
- National and regional regulations must be complied with.
- Safety requirements relating to work on electrical systems must be complied with.

WARNING
Risk of injury and damage caused by potential equalization currents!

Improper grounding can lead to dangerous equipotential bonding currents, which may in turn lead to dangerous voltages on metallic surfaces, such as the housing. Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- Follow the notes in the operating instructions.
- Install the grounding for the product and the system in accordance with national and regional regulations.

WARNING
Risk of injury due to damage to the device!

For reasons of safety, if a device shows visible signs of damage do not put it into operation, or take it out of operation immediately.

Possible damage (depending on the device type):
- Housing: cracking, splitting or fracture
- Electrical connections (male connector or female connector): cracks or detachment from the housing

WARNING
Health hazard as a result of high-frequency electromagnetic radiation!

Exposure of the human body to electromagnetic radiation must be limited. To do so, the device must have a minimum distance between its source of radiation (integrated antenna) and your body.

- For region-specific information on the required minimum distance as well as approval-compliant operation of the device, see Technical Information RFU65x Regulatory Compliance Information (part no. 8026893).

A printed copy of the document is enclosed with the device.

NOTE
The Technical Information RFU65x Regulatory Compliance Information can be found on the product page.

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3   Product description

3.1   Product ID

3.1.1   Type label

The type label specifies, amongst other things:

- Information for identifying the device type
- Technical data
- Region-specific information on approvals and, if applicable, fulfilled conformities
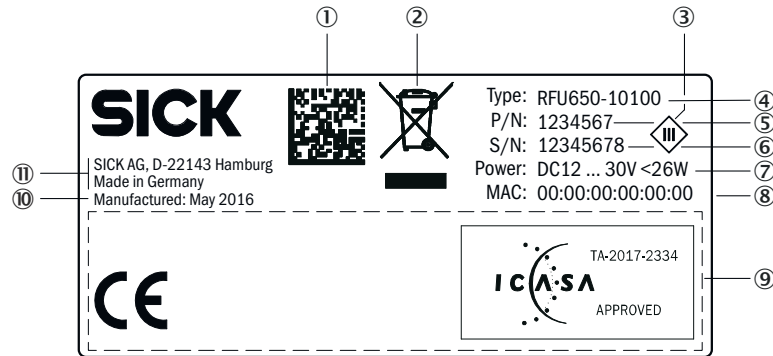
Figure 1: RFU650: Layout of the type label of the ETSI variant (example), see device for relevant data
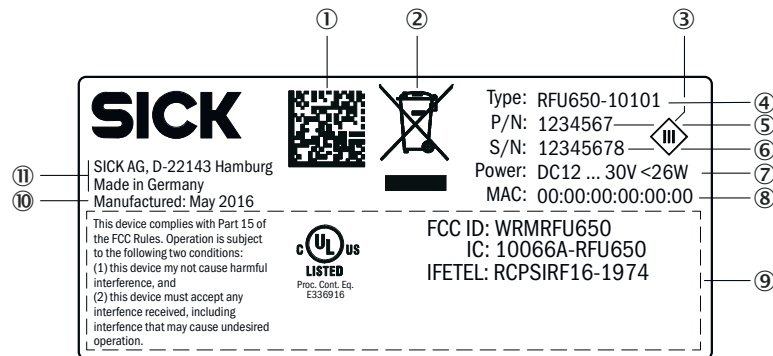
Figure 2: RFU650: Layout of the type label of the FCC variant (example) with UL certification, see device for relevant data

①   2D code (internal SICK code)

②   Marking according to electrical equipment directives

③   Protection class

④   Device identification according to type code

⑤   Part number

⑥   Serial number

⑦   Supply voltage and power consumption

⑧   MAC address (placeholder), device-specific

⑨   Field for approval-specific information (region-specific), conformity code and associated information, if applicable

⑩   Month and year of manufacture

⑪   Manufacturer and production site

Position on the device .

3.1.2 Type code

The devices of the RFU6xx product family are arranged according to the following type code:

RFUxyz-abcde

R	F	U	x	y	z	-	a	b	c	d	e
1	2	3	4	5	6		7	8	9	10	11

Position	Description	Characteristic
1 ... 2	RF (Radio Frequency Identification)	–
3	Frequency band	U: Ultra High Frequency
4 ... 5	Read range (working range)	61: ≤0.5 m (Short Range) 62: ≤2 m (Mid Range) 63: ≤10 m (Long Range) 65: ≤10 m (Long Range)
6	Device type	**0**: Basic type(ISO/IEC 18000-63, EPCglobal UHF Class 1 Generation 2)
7	Integrated (internal) antenna	**0**: No integrated antenna **1**: With integrated antenna, circularly polarized
8	Electrical connections for external antennas	**0**: No connection **3**: 3 connections **4**: 4 connections
9	Electrical connections	**1**: 1 male connector, M12, 17-pin, A-coded; 1 female connector, M12, 4-pin, D-coded **4**: Cable 0.9 m with male connector, D-Sub-HD, 15-pin **5**: 1 female connector, M12, 8-pin, X-coded **6**: 1 male connector, M12, 4-pin, A-coded, 1 female connector, M8, 4-pin, coded, 1 female connector, M12, 8-pin, X-coded **7**: 1 "IO-Link" male connector, M12, 4-pin, A-coded; 1 "Trigger" female connector, M8, 4-pin, coded
10 ... 11	Region-specific country radio equipment approval	xx: Country variant of the device Example 00: EU [1] For approvals, see type-specific Technical Information RFU6xx Regulatory Compliance Information, which is printed and enclosed with the device. Alternatively, see the product page of the device online.

[1] European Union.

NOTE
Not all combinations based on type code are possible. The available device variants can be found online on the product page of the device.

3.1.2.1 Device variants

The RFU65x product family consists of one variant line:

- RFU650-101xx (device with integrated antenna)

It is not possible to connect an external antenna.

Within the same variant line, the country variants differ with respect to the region-specific, non-modifiable radio approvals.

3.2 Product characteristics

3.2.1 Device view
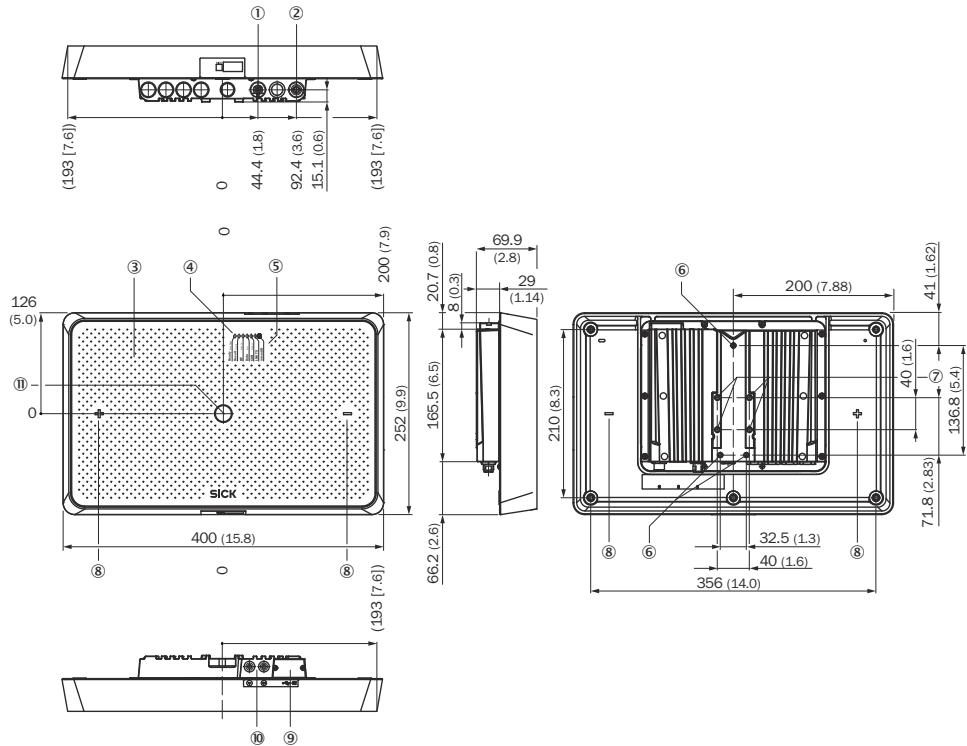
Figure 3: RFU650-101xx: Structure and dimensions, unit: mm (inch), decimal separator: period

① "Power/Serial Data/CAN/I/O" connection 1 (male connector, M12, 17-pin, A-coded)

② "Ethernet" connection 2 (female connector, M12, 4-pin, D-coded)

③ Optics cover with integrated antenna

④ 7 multi-colored LEDs (status indicator)

⑤ Acoustic opening of the beeper, under a cover film

⑥ Type label

⑦ 3 M5 threaded mounting holes, 8 mm deep, for mounting the device

⑧ 4 M6 threaded mounting holes, 11 mm deep, for alternative mounting of the device

⑨ Range definition for angle measurement of the transponders within this working range.

⑩ "USB" port (female connector, 5-pin, type Micro-B) and card slot for MicroSD memory card, behind screw-mounted cover. The USB interface is only for temporary use as a service interface.

⑪ 2 function buttons (Step ▾ and Enter ◄)

⑫ 1 LED, multi-colored (process feedback)

3.2.2 Read range

The environment influences the UHF field of the integrated antenna, making it impossible to provide a "clear" demarcation of the sensing range of the reading field:

- Application-specific reflections can result in both overreaches and "holes" (destructive interferences).
- Other factors that can significantly impact the read range include:
  - Orientation of the transponder antenna relative to the antenna of the device
  - Transponder quality: The quality depends on the antenna gain, the integrated transponder chip and its sensitivity, the reflected energy.
  - Material of the carrier object (plastic, wood, metal)
  - Objects between the device and transponder that can affect the UHF field (items, liquids, people).

In addition to the read results, the device can also output diagnostic data. The diagnostic data (e.g., RSSI values) provide an indication of the read quality. This diagnostic data can be used to achieve optimum read results when setting up the system.

The radiation pattern for the device's antenna was obtained in a reproducible environment for illustrative purposes. For this purpose, an anechoic chamber was used as a reflection-free room.

The diagram shows how the UHF field propagates in a reflection-free space. The diagram cannot be used to draw any conclusions on the likely sensing range of the reading field in a real on-site application.
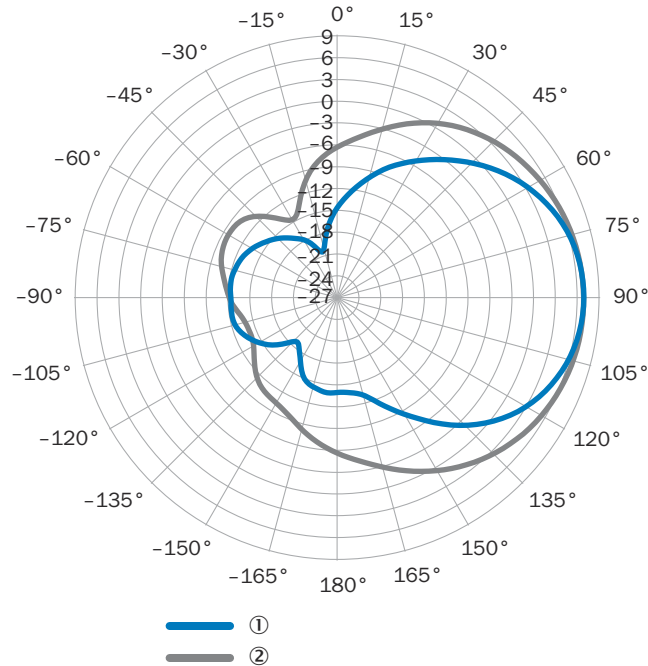

Figure 4: Radiation pattern of the integrated antenna of the RFU650 (typical): Measured antenna gain in dBic at 866.5 MHz, RHCP (right-hand circularly polarized)

①　　　Horizontal plane (azimuth)

②　　　Vertical plane (elevation)

②　　　Vertical plane (elevation)
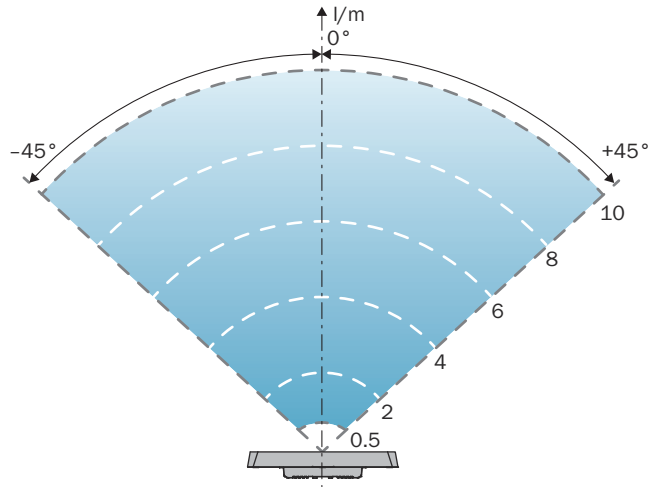
Figure 5: Working range diagram of the RFU650 integrated antenna

> **NOTE**
> The values given in the diagrams are achieved with optimal alignment of the transponder relative the antenna of the device. see "Mounting the device", page 28

3.2.3 Scope of delivery

The delivery of the device includes the following components:

Table 2: RFU650-101xx: Scope of delivery

No. of units	Component	Notes
1	Device in the ordered country variant (xx = region assignment)	Delivery state: • The M12 electrical connections are equipped with screwed on protective elements, e.g., protective caps. • The shared side cover of the USB interface and the card slot for an optional memory card is closed and screwed tight. Without connecting cables and brackets
1	Printed Safety Notes (safety information), multilingual	The document contains: • Information on safe handling of the device • Note for online access to the operating instructions and other documentation
1	Printed Technical Information RFU65x Regulatory Compliance Information, multilingual	The document includes information on: • Regions for which the device is approved in a country or group of countries • Conformities fulfilled • If applicable, country-specific operating conditions to be upheld when operating the device

The following associated configuration and information components are not included in the delivery. The components are available online via the product page of the device or the configuration software.

Table 3: RFU650-101xx: other associated components

Component	Note
SOPAS ET configuration software and device description file (*.sdd-file) for the RFU65x	Available online at: • www.sick.com/SOPAS_ET

Component	Note
RFU65x operating instructions as PDF in English, French and German. Other languages may be available.	Available on the product page of the device
RFU parameter description as PDF in English and German.	

Accessories

The following accessories for constructing a complete RFID read/write station are not included in the scope of delivery of the device. If required, order accessories separately.

- Connecting cables
- Read cycle trigger sensor, e.g. photoelectric retro-reflective sensor for object-specific triggering
- CDB650-204, CDM420-0006 connection module or CDF600 fieldbus module
- UHF transponder
- Mounting accessories

The actual scope of delivery may differ for special designs, additional orders or due to the latest technical changes.

3.2.4 Product features and functions (overview)

i NOTE

In addition to the existing operating instructions, the use of the RFU parameter description is recommended:
- This parameter description explains the UHF-RFID-specific parameters of all device variants of the RFU6xx product family up to and including the "Service" user level.
- The parameter description assists with setting up applications using the SOPAS ET configuration software.

The RFU parameter description is available in English (part no. 8023085) and German (part no. 8023084) as well as in other languages, if required.

i NOTE

The RFU parameter description can be found on the product page.

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Table 4: RFU650-101xx: Overview of product features and functions of the device

Product feature/function	Characteristic

Safety and convenience for the customer	• Industrial-grade, compact metal housing, CE marking (EU)
	• Automatic self-test at system start
	• Diagnostic tools for device setup and (remote) device monitoring
	• Configurable output of the read results including read diagnostics data in two output formats
	• Operating data request. In the event of an error: output of codified error messages on request
	• Future-proof due to firmware update via data interface
	• Future-proof SOPAS ET configuration software with password-protected configuration mode
	• Wide supply voltage range
	• Low power consumption
	• Wide ambient temperature range, details see "Ambient data", page 78 in the technical data
	• Parameter cloning (to back up the configuration data in the internal device memory):
	   o Externally by inserting a microSD memory card [1] into the device
	   o Externally via the CMC600 [1] parameter cloning module in the CDB650-204 [1] or CDM420-0006 [1] connection module.

Convenient operation and configuration	• Configuration (online or offline) using SOPAS ET configuration software • Single Tag ID Wizard (assistant) to help with initial configuration • Configuration and starting of device functions via a web server (SOPASair) or command strings • Optional function blocks for easier integration of the device into PLC programs • PROFINET Single Port: Configuration via GSD parameterization • Application-specific programming possible using the SICK AppStudio development environment. You can find further information on the Internet at: www.sick.com/SICK_AppStudio • Status and process feedback indicators via LEDs • 2 pushbuttons on the device for executing preset functions without connecting a computer • Deactivatable beeper for confirming device functioning
Reading Operation Mode	• Start/stop operation: For reading one or more transponders during a read cycle
Read cycle	• Read cycle start condition is configurable in the object trigger control settings: digital inputs etc. • Read cycle stop condition is configurable in the object trigger control settings: digital inputs etc.
Radio interface(s)	• Integrated antenna
Transponder Processing	• The RFU650 base model supports all standard passive transponders compatible with ISO/IEC-18000-63 and EPCglobal UHF Class 1 Generation 2 • Reading, writing, and multiple overwriting of the data on the transponders, depending on the application • Within a process chain, the device supplying the data is a partial component for the complete visualization of data
Transponder management	• Decoding of the UII in HEX, BIN and ASCII. Supports GS1-TDS and other industry-specific standards such as VDA55xx • Additional detection of the passage and direction of movement of transponders in the reading field

Product feature/function	Characteristic
Data processing	• Variable read data output based on event-dependent evaluation conditions • Influencing the output string by filtering and output sorting • Implementation of application-specific data output protocols using the SICK AppStudio development environment
Data communication	**Host interface** • 2 configurable data output formats • The output is switchable to different physical or logical interfaces. Parallel operation is possible. The interface is used for data output to the processing computer. **AUX interface** • The output is switchable to different physical or logical interfaces. The interface is used for configuration and diagnostics of the device as well as transponder access.

Electrical Interfaces	• Host interface
	  o RS-232, RS-422 (configurable data format and protocol), CAN
	  o Ethernet (supported protocols include, amongst others, PROFINET single port)
	• AUX interface
	  o RS-232 (fixed data format, data transmission rate and protocol)
	  o Ethernet, USB [2]
	• CAN interface for integrating the device into the SICK-specific CAN-SENSOR network.
	• 2 digital inputs
	• 2 digital outputs
	• Expandable with 2 software-controlled digital inputs and digital outputs respectively via the CMC600 [1] parameter cloning module in the CDB650-204 [1] or CDM420-0006 [1] connection module
	• Voltage supply

Connectivity (Design)	• 2 M12 round connectors, 1 female connector (USB, type Micro-B)

[1] Optional accessories.
[2] The USB interface is only for temporary use as a service interface.

3.2.5 Memory card

The device offers a card slot integrated in the housing that accommodates a memory card in MicroSD format.

> **(i) NOTE**
> The memory card is an optional accessory and is not included with delivery.

> **(i) NOTE**
> Only use types approved by SICK to ensure reliable function of the memory card.

> **(i) NOTE**
> Memory cards can be found on the product page.
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
> {P/N} corresponds to the part number of the product, see type label.
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

The memory card has no write protection that can be activated.

Memory functions

An inserted memory card serves as a local external storage medium for the device outside the internal device memory, see "Information on initial commissioning", page 60.

The device can execute the following functions using the memory card:

- **Cloning function: storage of the currently valid parameter set**
  Additional storage of the internal parameter set (configuration data of the device) on an external storage medium. This takes place as part of the recommended backup concept for the parameter sets of the 4Dpro devices. The externally stored parameter set is also updated automatically each time the currently valid configuration data is permanently saved.
  - This function is initiated by using the "save permanently" option to save the internal parameter set, e.g., via the SOPAS ET configuration software.
  - The function is used, among other things, to conveniently transmit the parameter set to an exchange unit of the same type in the event of an fault.
  - A memory card that can be plugged into the device serves as an optional, external medium. Alternatively, the CMC600 parameter cloning module in the CDB650-204 or CDM420-0006 connection module.
- **Data logging: Recording of read diagnostic data**
  Continuous recording of read diagnostic data after initial manual start, e.g. via SOPAS ET. If the function is set permanently, the device continues recording after a restart.
- Other functions on request

NOTE

Use an empty memory card to save a parameter set or read diagnostic data for the first time.

▶ To do this, check the contents of the current card on the computer using a card reader. Delete existing content if necessary.

Indication of operational readiness

The "microSD" optical display shows the status of the memory card after installation of the card in the device. It lights up in different colors according to the status, see "Optical status indicators on the display panel", page 63.

NOTICE
Possible data loss

The color green (operational) indicates that the memory card is ready for use, not that the device has actually accessed the memory card by reading or writing.

Do not remove the memory card or switch off the supply voltage while one of the following functions with access to the memory card is running in the device using the SOPAS ET configuration software:

- Saving a new, current parameter set
- Data logging (read diagnostic data)
- Firmware update

Inserting the memory card in the device:

NOTICE
Risk of damage to the memory card

▶ To safely install the memory card, insert the card only when the device is in a **de-energized** state. To do this, disconnect the device from the supply voltage beforehand.

Ensure the IP67 enclosure rating of the device is maintained, see "Conditions for specified enclosure rating", page 9.

The card slot on the device is located on the side behind the aluminum cover.
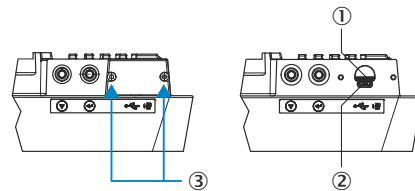
Figure 6: Card slot and "USB" port

①   Slot for MicroSD memory card

②   "USB" connection (female connector, 5-pin, Micro B type)

③   2 screws (hexagon socket, SW 2 mm)

1. Switch off the supply voltage to the device.
2. To remove the cover, unscrew both screws.
3. Making sure it is in the correct position, insert the memory card into the card slot until it locks into place. When doing so, orient the contacts so that they are facing towards the device and downwards as per the symbol on the device.
4. Screw the cover back on. Recommended tightening torque for the cover screws: 40 Ncm ± 5 Ncm.
5. Switch on the supply voltage for the device.

Interpretation of the stored parameter set

The device automatically detects that a memory card is present after switching it on. Depending on the content of the card, the device behaves as follows:

- If the memory card is empty or if does not contain a parameter set that can be interpreted by the device: the device saves its currently valid internal parameter set to the card (provided there is sufficient storage space) and starts with the internal parameter set.
- If the card contains a parameter set that can be interpreted by the device: The device overwrites the previously valid internal parameter set with this external parameter set.

The goal is for the internal parameter set and the parameter set saved externally to always be identical.

Removing the memory card from the device:

To safely remove the memory card while the device is running, deactivate the card using the SOPAS ET configuration software and release it for removal.

!   **NOTICE**
Risk of damage to the memory card

- ► To safely remove the memory card while the device is in operation:
  - o In SOPAS ET under **Analysis/SD card**, run the **Remove SD card** command. Wait for feedback from SOPAS ET.
  - o If this command is not accessible, the memory card can also be removed when there is no power to the device.

---

4   Transport and storage

4.1   Transport

> **!** NOTICE
> **Damage due to improper transport!**
>
> - The product must be packaged with protection against shock and damp.
> - Recommendation: Use the original packaging.
> - Note the symbols on the packaging.
> - Do not remove packaging until immediately before you start mounting.

4.2   Unpacking

- To protect the device against condensation, allow it to equilibrate with the ambient temperature before unpacking if necessary.
- Handle the device with care and protect it from mechanical damage.
- To avoid ingress of dust and water, only remove the protective elements, e.g. protective caps of the electrical connections just before attaching the connecting cable.

4.3   Transport inspection

Immediately upon receipt in Goods-in, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

> **i** NOTE
> Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.4   Storage

- Electrical connections are provided with a protective cap.
- Do not store outdoors.
- Store in a place protected from moisture and dust.
- Recommendation: Use the original packaging.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 75.
- Relative humidity: see "Technical data", page 75.
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Overview of mounting procedure

The procedure for mounting the device is divided into the following steps:

1. Select a suitable mounting location for the device.
   The mounting location and position depend on the following factors:
   - Identification task
   - Working range of the device (see "Read range", page 15)
   - Transponder used
   - Environmental influences

2. Mount the device at the intended reading point.
3. Preliminarily align the device to the object with transponder. Make sure that there is a suitable distance to the object.
4. If required, mount the read-cycle sensor for object-specific triggering.

After the electrical installation is complete and while adjusting the device parameters to suit the application:

5. **Finely** align the device to the object and adjust it.
6. Test for successful reading and writing of the device in operational use of the application.

5.2 Preparing for assembly

5.2.1 Installation requirements

Space requirements

For the typical space requirements, see the:

- Dimensional drawing of the device see "Device view", page 15 as well as shape and extent of the reading field see "Read range", page 15.
- The device does not require any physical or visual contact with the transponders. However, align the device with the reading space.

Environmental influences

- Comply with technical data such as the permissible ambient conditions for operation (e.g., ambient temperature range), see "Ambient data", page 78 in the technical data.
- To prevent condensation, avoid exposing the device to rapid changes in temperature.
- To prevent additional external heating of the device, protect the device against direct and indirect sunlight.
- For outdoor applications, use suitable weather protection to protect the device from additional external heating by sunlight.
  Suitable weatherproof housings can be found online on the product page of the device.
- In order to avoid reflections of the UHF waves and any associated physical phenomena, make sure if possible that there are no metal surfaces on the side of the device in the direction of the transponder.
  Possible disturbances of the UHF field caused by reflections of the UHF waves are:
  - Overreaches
  - "Holes" (destructive interferences)

- To avoid attenuation of the UHF field by absorption, exclude the following between device and transponder:
    - Electrically conductive material, e.g. liquids (water)
    - Persons or animals

Enclosure rating

- For further information, see "Conditions for specified enclosure rating", page 9

Mounting

- Fasten the device using the M6 threaded mounting holes provided for this purpose on the rear of the device. Alternatively, use the M5 threaded mounting holes. Use the full number of threaded mounting holes of the selected thread size.
- Mount the device where they will not be exposed to shocks or vibration. In mounting situations with strong vibrations, it may be necessary to provide shock mounts.

5.2.2 Mounting instructions for ambient temperature range below 0 °C

The device can also be operated at low ambient temperatures. Details see "Ambient data", page 78 in the technical data.

For the electrical installation procedure see "Instructions for electrical installation when the ambient temperature can fall below 0 °C", page 41.

> **i** **NOTE**
> Do not expose the device to strong air movement, e.g. a ventilation system. The device may otherwise not be able to provide the required heating power. If necessary, shield the device from air movement with suitable means.

> **!** **NOTICE**
> If the ambient temperature is below 0 °C, please note:
>
> - **Do not** move the connecting cables to the device and optional CDB or CDM connection module or CDF600 fieldbus module.
> - **Do not** operate the configuration switch on the optional connection module or fieldbus module.

5.2.3 Auxiliary equipment required

- Mounting device (bracket) with sufficient load-bearing capacity, see "Mechanics and electronics", page 78 in the technical data and suitable dimensions, see "Device view", page 15.
- 3 M5 screws or 4 M6 screws for mounting the device to a bracket

> **i** **NOTE**
> The screws are for mounting the device on mounting equipment supplied by the customer. The screw length required depends on the mounting base (wall thickness of the bracket).
>
> When using an optional SICK bracket, screws of appropriate length for mounting the device on this bracket are included in the scope of delivery.

> **!** **NOTICE**
> **Possible damage to the device**
>
> Screws that are not suitable for the length of the threaded mounting holes can damage the device.
>
> - M5 threaded mounting holes: Do not exceed the maximum screw-in depth of 8 mm
> - M6 threaded mounting holes: Do not exceed the maximum screw-in depth of 11 mm

- Tool and tape measure

5.2.4 Mounting device

The device is fixed with three M5 threaded mounting holes or four M6 threaded mounting holes. The threaded mounting holes are located on the rear of the device, see "Device view", page 15.

Optional SICK brackets

The device can be mounted using one of the following brackets: optional SICK bracket, a combination of SICK brackets and elements, or a customer-specific bracket.

SICK offers prefabricated brackets which are suited for mounting the device in various applications.

> **i** **NOTE**
> Mounting accessories can be found on the product page.
>
> The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}
>
> {P/N} corresponds to the part number of the product, see type label.
>
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

Example 1: The pivoting bracket enables, for example, the device to be aligned in two axes.
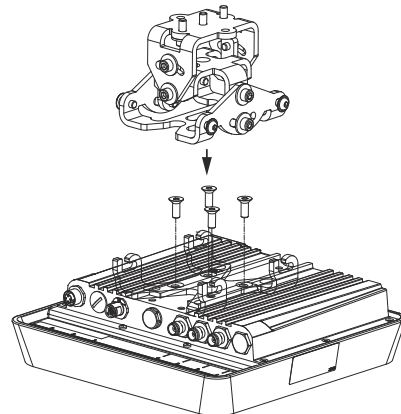
Figure 7: Pivot bracket, shown here with the RFU630-131xx

Example 2: Combination of SICK fastening elements
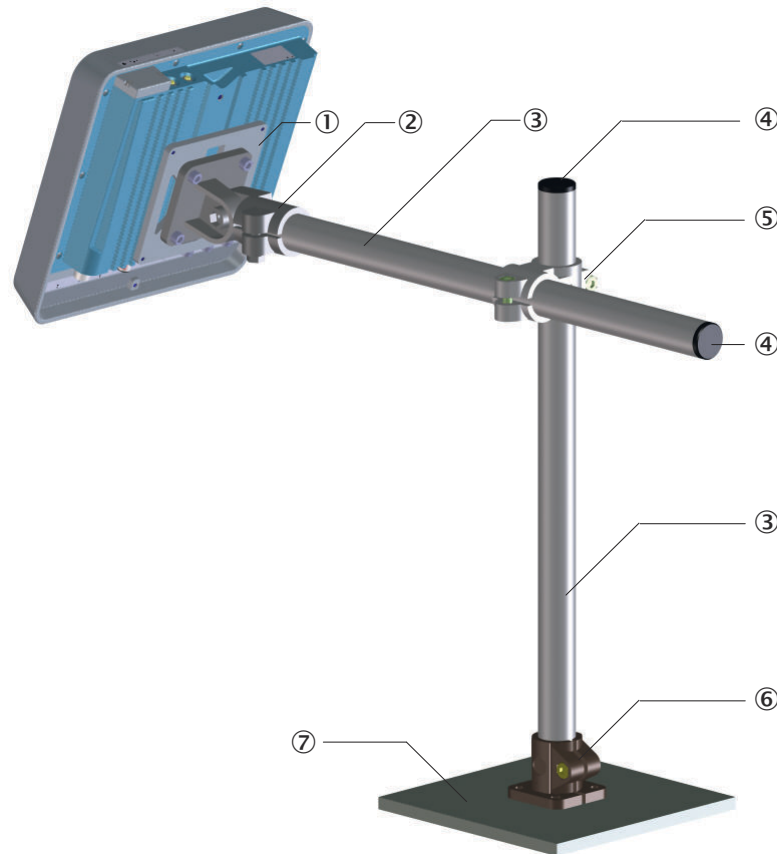
Figure 8: Bracket made of VESA adapter plate, pipe elements and clamp connectors, device can be aligned in three axes. Shown here mounted on the RFU630-131xx

①   VESA adapter plate part no. 2071862 with 2 M6 x 12 countersunk head screws, hexagon socket (WAF 4)

②   Hinged clamp part no. 2068919 with 4 x M6 x 12 cylinder head screws, hexagon socket (WAF 5)

③   Pipe, external diameter 30 mm, length 1 m, part no. 5327610

④   Sealing plug, outside diameter 30 mm, part no. 5327613

⑤   Cross clamp, part no. 5327612

⑥   Base clamp, part no. 5327611

⑦   Base (e.g. plate, supplied by the customer)

ⓘ NOTE

Dimensional drawings for SICK brackets and, if applicable, mounting instructions can be found online at: **www.sick.com**

▶   To do so, enter the 7-digit part number of the bracket in the search field.

Customer-supplied brackets

A supplied bracket must meet the following requirements:

- Stable mounting device
  - Orientation of the device changeable in the x- and y-axis
  - The mounting device must be able to bear the weight of the device, including connecting cables, in a shock-proof manner, see "Mechanics and electronics", page 78 in the technical data.
  - In mounting situations with strong vibrations, it may be necessary to provide shock mounts.

- Mounting the device according to the dimensional drawing: 4 suitable holes for M6 screws or 3 holes for M5 screws.

5.3 Mounting location

Installing a device at the mounting location

Observe the following aspects for the device when selecting the installation location:

- The spatial working range of the device's antenna in terms of the distance to objects, see "Read range", page 15.
- Influence of the environment on the UHF field produced by the device, e.g.:
  - Metal surfaces located to the side of and in the vicinity of the device
  - Electrically conductive liquids between the antenna and transponder
  - Persons between the antenna and transponder

5.4 Mounting the device

⚠️ **WARNING**
Risk of injury due to damage to the device!

For reasons of safety, if a device shows visible signs of damage do not put it into operation, or take it out of operation immediately.

Possible damage (depending on type):
- Housing: cracking, splitting or fracture
- Electrical connections (male connector or female connector): cracks or detachment from the housing

❗ **NOTICE**
Risk of damage to the device

Observe the maximum screw-in depth of the blind tapped holes on the device. Longer screws than the specified screw-in depth damage the device.

► Use screws of suitable length.

Observe the maximum screw-in depth of the threaded mounting hole see "Auxiliary equipment required", page 25

Aligning the transponder to the antenna of the device

UHF transponders have dipole antennas and therefore preferential directions within the radiation field of the antenna of the device. The transmitting and receiving performance will be higher or lower depending on the orientation of the dipole antenna of the transponder to the axis perpendicular to the antenna surface. The read and write rate as well as the sensing range can therefore be subject to fluctuations.

ℹ️ **NOTE**
If the dipole antenna of the transponder is aligned along the axis perpendicular to the antenna surface, the device cannot read or write to the transponder.
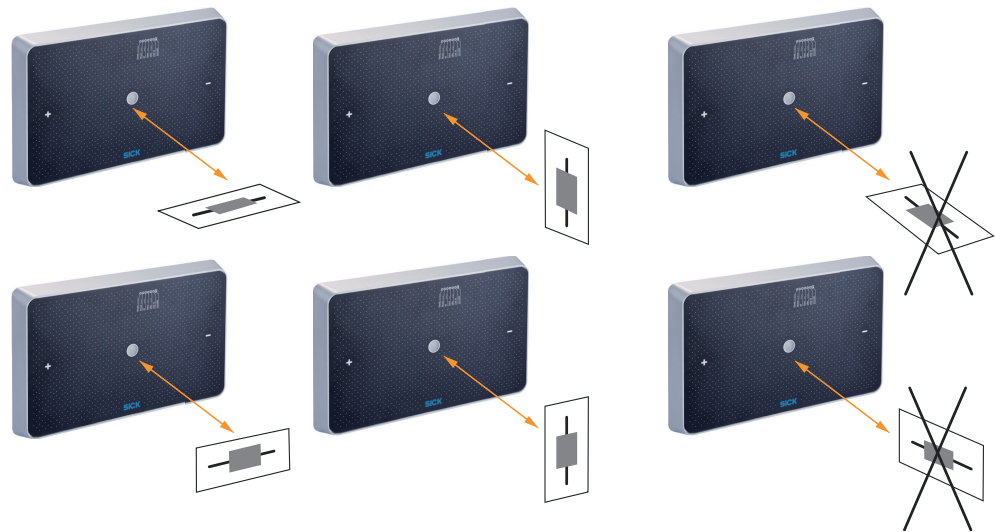
Figure 9: Alignment of the UHF transponder, optimized for good read and write capability

Mounting and aligning the device :

ⓘ **NOTE**
Avoid mutual interference when operating several devices

When the reading and writing ranges of several independently operated devices over-lap, this can lead to mutual impairment of the system performance of the devices.

To avoid such constellations, the devices offer the following options:

- Synchronization of multiple devices:
  Sync Mode can be used to synchronize the read and write behavior of multiple devices. For this purpose, the devices are connected to one another via an Ethernet network. Sync mode then ensures that only one device at a time is communicating over the air interface for a read or write operation. A defined device coordinates up to seven subordinate devices.

1. Prepare the base for mounting the bracket of the device, see "Preparing for assembly", page 24.
   Recommendation: Depending on the application it may be possible to use one of the optional SICK brackets. If necessary, perhaps also in combination with other brackets
2. At the intended reading point, place an object with transponder within the working range of the device (static object only).
3. Mount the device bracket onto the base.
4. Screw the screws through the bracket into the blind tapped hole of the device. Slightly tighten screws.
5. Orient the front side of the device towards the object.

- o Ensure, where possible, that there are no large metal surfaces located in front of the device.
- o If this is unavoidable, do not mount the device in the same plane as the surface but rather maintain an angle of inclination of approx. 10°.
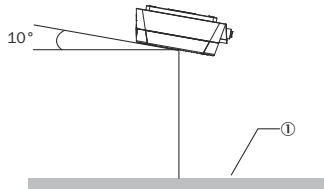

Figure 10: Selected angle of inclination of the device or external antennas when there is a large metal surface in front, e. g., 10°

① Metal surface

6. Tighten the screws.
✓ The device is approximately aligned with the object to be detected.
7. Check the general suitability of the alignment for objects of different sizes and varying positions of the transponder in operational use of the application.

5.5 Mounting external components

5.5.1 Mounting the connection module or fieldbus module

ℹ **NOTE**
On the product page you will find connection modules and fieldbus modules as well as accompanying operating instructions for the modules.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

The operating instructions contain detailed information on mounting and electrical installation of the modules.

Circuit diagrams for the individual interfaces of the device, specific to the available connections modules, can be found in the Annex of the RFU65x operating instructions.

Mount each module in the vicinity of the device in such a way that the module can be accessed.

ℹ **NOTE**
If the computer with the SOPAS ET configuration software accesses the AUX interface (RS-232; 57.6 kBd) of the device via the connection module or fieldbus module, do not locate the connection module more than a 5 m cable length from the device.

5.5.2 Mounting the external read cycle trigger sensor

Conveying line

To detect objects with transponders, mount the trigger sensor in suitable proximity to the device . Attach the sensor in front of the device against the conveying direction.

ℹ **NOTE**
A large selection of photoelectric sensors and accessories (brackets, connecting cables) can be found online at: **www.sick.com**

6 Electrical installation

6.1 Safety

6.1.1 Prerequisites for safe operation of the device

> ⚠ **WARNING**
> **Risk of injury and damage caused by electrical current!**
>
> As a result of equipotential bonding currents between the device and other grounded devices in the system, faulty grounding of the device can give rise to the following dangers and faults:
>
> - Dangerous voltages are applied to the metal housings.
> - Devices will behave incorrectly or be destroyed.
> - Cable shielding will be damaged by overheating and cause cable fires.
>
> **Remedial measures**
>
> - Only skilled electricians should be permitted to carry out work on the electrical system.
> - If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
> - Ensure that the ground potential is the same at all grounding points.
> - Where local conditions do not meet the requirements for a safe earthing method, take appropriate measures. For example, ensure low-impedance and current-carrying equipotential bonding.

The device is connected to the peripheral devices (any local trigger sensor(s), system controller) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the device.

The device can be grounded through the cable shield or through a blind tapped hole in the housing, for example.

If the peripheral devices have metal housings and the cable shields are also in contact with their housings, it is assumed that all devices involved in the installation have the **same ground potential**.

This is achieved by complying with the following conditions:

- Mounting the devices on conductive metal surfaces
- Correctly grounding the devices and metal surfaces in the system
- If necessary: low-impedance and current-carrying equipotential bonding between areas with different ground potentials
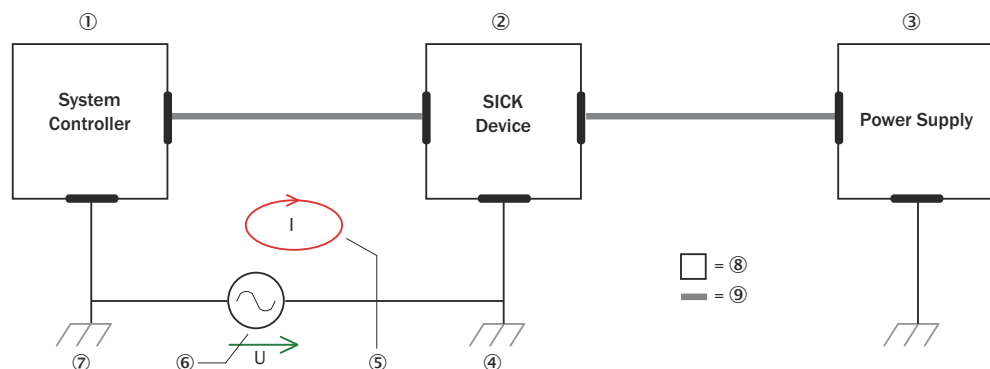

Figure 11: Example: Occurrence of equipotential bonding currents in the system configuration

① System controller

②   Device

③   Voltage supply

④   Grounding point 2

⑤   Closed current loop with equalizing currents via cable shield

⑥   Ground potential difference

⑦   Grounding point 1

⑧   Metal housing

⑨   Shielded electrical cable

If these conditions are not fulfilled, equipotential bonding currents can flow along the cable shielding between the devices due to differing ground potentials and cause the hazards specified. This is, for example, possible in cases where there are devices within a widely distributed system covering several buildings.

Remedial measures

The most common solution to prevent equipotential bonding currents on cable shields is to ensure low-impedance and current-carrying equipotential bonding. If this equipotential bonding is not possible, the following solution approaches serve as a suggestion.

> **!** **NOTICE**
> We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be complied with and that the safe operation of the device data interfaces can no longer be guaranteed.

Measures for widely distributed system installations

On widely distributed system installations with correspondingly large potential differences, the setting up of local islands and connecting them using commercially available **electro-optical signal isolators** is recommended. This measure achieves a high degree of resistance to electromagnetic interference.

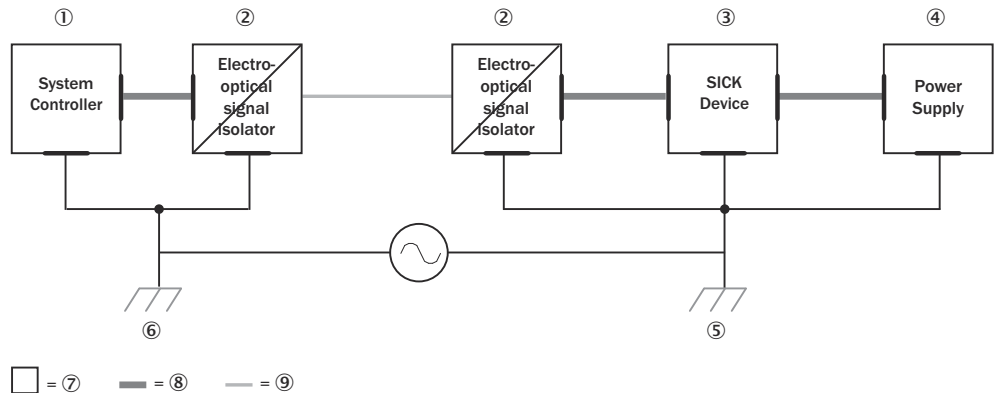*Figure 12: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators*

①   System controller

②   Electro-optical signal isolator

③   Device

④   Voltage supply

⑤   Grounding point 2

⑥   Grounding point 1

⑦   Metal housing

⑧   Shielded electrical cable

⑨   Optical fiber

The use of electro-optical signal isolators between the islands isolates the ground loop. Within the islands, a stable equipotential bonding prevents equalizing currents on the cable shields.

Measures for small system installations

For smaller installations with only slight potential differences, insulated mounting of the device and peripheral devices may be an adequate solution.
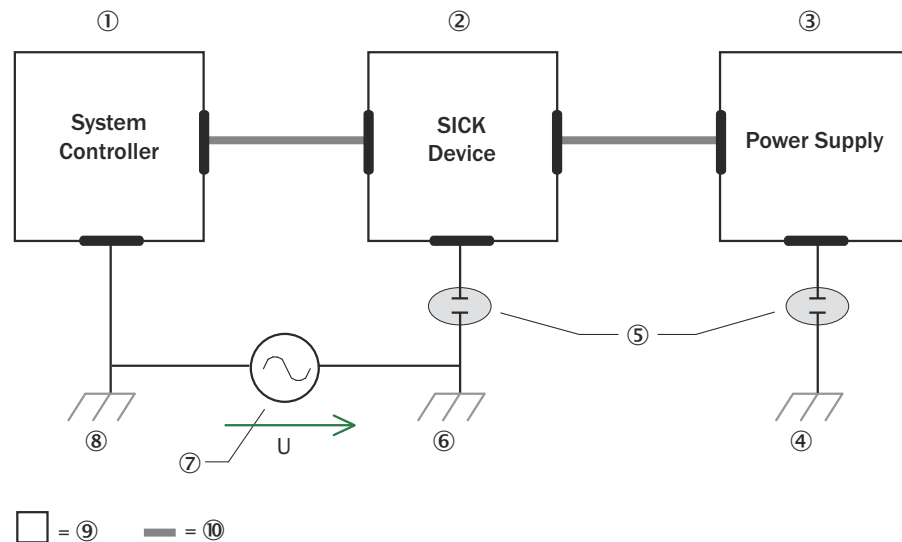
Figure 13: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

①　System controller
②　Device
③　Voltage supply
④　Grounding point 3
⑤　Insulated mounting
⑥　Grounding point 2
⑦　Ground potential difference
⑧　Grounding point 1
⑨　Metal housing
⑩　Shielded electrical cable

Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.

> **!** **NOTICE**
> The voltage supply for the device and the connected peripheral devices must also guarantee the required level of insulation.
>
> Under certain circumstances, a tangible potential can develop between the insulated metal housings and the local ground potential.

6.1.2　Notes on electrical installation

Connection work

- Standard safety requirements must be observed when working on electrical systems!
- Electrical installation must only be performed by electrically qualified personnel.
- Select all cables to suit the ambient temperature range at the installation site.

- Perform all connection work only at ambient temperatures above 0 °C.
- Electrical connections between the device and other devices may only be made or separated in a voltage-free state. Otherwise, there is a risk of damaging the devices.
- All circuits connected to the device must be designed as ES1 circuits.
- The wire cross-sections of the data cables and cables for digital inputs and digital outputs must comply with the applicable national standards.
- In the case of open end connecting cables, make sure that bare wire ends do not touch. Risk of short-circuit when the supply voltage is switched on! Wires must be properly insulated from each other. This also applies to unused wires.

> **NOTE**
> For additional instructions on operating the device at ambient temperatures below 0 °C: see "Prerequisites", page 41

Supply voltage

- Connect the device to the permissible supply voltage, see "Supply voltage", page 43.
- The wire cross-sections of the customer-supplied power supply cable must be selected in accordance with the applicable national standards. In Germany, observe the following standards: DIN VDE 0100, part 430 and DIN VDE 0298, part 4 or DIN VDE 0891, part 1.
- Only switch on the supply voltage to the device or optional connection module or fieldbus module depending on the type after first:
  - Completing the connection work
  - Carefully checking the wiring work

Data cables

> **NOTE**
> **Layout of data cables**
> - Use shielded data cables with twisted-pair wires.
> - The allowed cable length between the device and host computer depends on:
>   - The chosen physical version of the host interface
>   - The data transmission rate set in the device
>   For further information, see "Wiring data interfaces", page 45.
> - Implement the shielding design correctly and completely.
> - To avoid interference, always use EMC-compliant cables and layouts. This applies, for example, to cables for switched-mode power supplies, motors, clocked drives, and contactors.
> - Do not lay cables in parallel with voltage supply cables or motor cables in cable channels over longer distances.

Enclosure rating

For further information, see "Conditions for specified enclosure rating", page 9.

> **!** **NOTICE**
> **Risk of damage to the product when the cover is open**
> When the cover is open, the device does not conform to a specified enclosure rating.
>
> If necessary, only operate the device for a short time with an open cover for the activities listed in the following: During this time, protect the device against moisture and dust.

Temporarily open the side cover for the following tasks:
- Inserting or removing the optional storage medium
- Temporary use of the USB interface as a service interface

6.2 Wiring instructions

Pre-assembled cables:

> **NOTE**
> You will find recommended connecting cables and associated technical data on the product page.
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
> {P/N} corresponds to the part number of the product, see type label.
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

Pre-assembled cables with open cable end at one end:

> **NOTE**
> For information on the pin, signal and wire color assignments for the RFU650 device, see "Signal assignment of cables with open cable end at one end", page 81 in the appendix of these operating instructions.

> **NOTICE**
> **Faults during operation and defects in the device or the system**
> Incorrect wiring may result in operational faults and defects.
> - Follow the wiring notes precisely.

6.3 Overview of all interfaces and connection options

> **NOTE**
> The numbering of the data interfaces (Host 1, AUX 1) in the following block diagrams is intended to provide a better overview. The numbering is not shown in configuration tools, e.g. in the SOPAS ET configuration software.

> **NOTE**
> The USB interface of the device is used in industrial environments only as a service interface for temporary use (e.g. for configuration, troubleshooting). Permanent use in operational use of the system as a host interface is not intended.

6.3.1 Data interfaces

Service operation

The following functions can be performed via one of the five data interfaces:

AUX 1, AUX 2, AUX 3, Host 1 or Host 2
- Configuration of the device
- Display of the read result of the detected transponders
- Transponder access: Reading or writing data
- Reading diagnostics (read result in fixed output format)

For a detailed overview, see "Use of the data interfaces", page 38.

Shown here are alternatives for the AUX interface:

- AUX port of the Ethernet interface
- Serial data interface
- USB interface

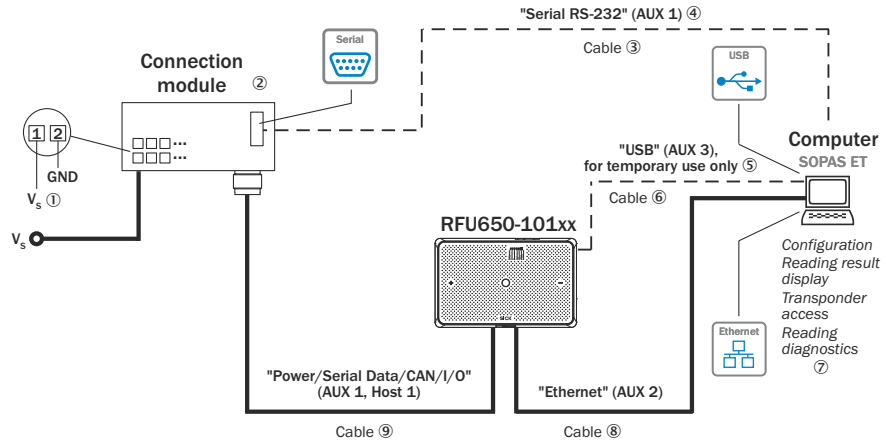The USB interface must only be used temporarily as a servicing interface.

Figure 14: Service mode, e.g. displaying the read result: Block diagram for the RFU650-101xx with optional connection module

① Supply voltage V_S

② Connection module CDB650-204 or CDM420-0006

③ Null modem cable with two female connectors, D-Sub, 9-pin, crossed TxD and RxD

④ Serial RS-232, alternative to USB or Ethernet AUX port

⑤ USB, alternative to serial RS-232 or Ethernet AUX port The USB interface must only be used temporarily as a servicing interface.

⑥ Adapter cable with male connector, USB, type Micro-B and male connector, USB, type A

⑦ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics

⑧ Adapter cable with male connector, M12, 4-pin, D-coded and male connector, RJ-45, 8-pin

⑨ For CDB650-204: connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded

For CDM420-0006: Adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin

Read operation

During operation, the device sends the read result via one of the two physical host interfaces to a computer for further processing. Select one of two configurable output formats for this purpose.

The device can also output the same output format or a second output format via:

- The second host interface
- Both AUX interfaces in parallel

For a detailed overview, .

Figure 15: Read operation: Block diagram for the RFU650-101xx with optional connection module

①	Digital output 2, e.g. for connecting a LED
②	Digital output 1, e.g. for connecting a LED
③	Digital input 2, e.g. for connecting an incremental encoder
④	Digital input 1, e.g. for connecting a read cycle sensor
⑤	Supply voltage V_S
⑥	Connection module CDB650-204 or CDM420-0006
⑦	For CDB650-204: connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
	For CDM420-0006: Adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin
⑧	Adapter cable with male connector, M12, 4-pin, D-coded and male connector, RJ-45, 8-pin
⑨	Read result (configurable output format 1 or 2)
⑩	Data further processing
⑪	Serial host rather than Ethernet host port

ℹ️ **NOTE**

As an option, two additional external digital inputs and outputs are available for the device. Parameter cloning module CMC600, installed in the Connection Device Basic or Connection Device Modular connection module, is required for this purpose.

The modules can be delivered as optional accessories.

For details of the characteristics of the external digital inputs and outputs, see "Wiring digital inputs ", page 47 and see "Wiring digital outputs ", page 49.

6.3.2 Use of the data interfaces
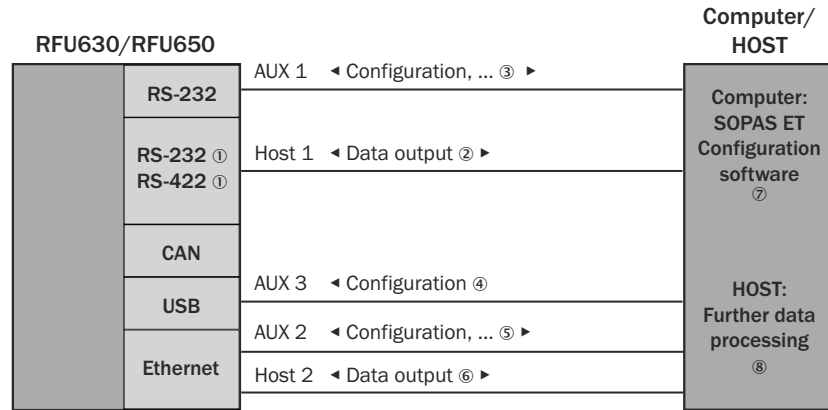

Figure 16: RFU650: Data interfaces and their preferred use

① One of the two interface options can be selected

② Read operation: Data output of the read result (configurable output format 1 or 2)

③ Service operation: Configuration with SOPAS ET, prepared representation of the read result, transponder access, reading diagnostics or monitoring of the serial host interface

④ Service operation: Configuration with SOPAS ET. The USB interface must only be used temporarily as a servicing interface.

⑤ Service operation: Configuration with SOPAS ET, processed read result display, transponder access or reading diagnostics

⑥ Read operation: Data output of the read result (configurable output format 1 or 2), recommended for high data volume

⑦ SOPAS ET configuration software

⑧ Data further processing

Table 5: RFU650: Functions relating to data interfaces

Interface option → Assignable function ↓	Host 1	AUX 1	Host 2	AUX 2	AUX 3
	Serial RS-232 or RS-422	Serial RS-232	Ethernet	Ethernet	USB [1]
Read result output (configurable format 1 or 2)	●	●	●	●	
Read result output (customer output format)	●				
Read diagnostics (fixed output format)		●		●	● [2]
Monitoring of serial host interface traffic		●			
With SOPAS ET: Configuration, display of read result in the Quickstart window, transponder access	○	○	○	○	○
Configuration using commands	○	○	○	○	○
Configuration using web server			○	○	

● = Output of the same function via the parallel interfaces is possible
○ = Access only makes sense via one of the interfaces (risk of collision!)

[1] The USB interface must only be used temporarily as a servicing interface.
[2] Output using the terminal in SOPAS ET (from version 3.3.0) or other USB-capable terminal programs.
[3] Input using the terminal in SOPAS ET (from version 3.3.0) or other USB-capable terminal programs.

> **NOTE**
> - Only one of several available functions can be assigned to each interface.
> - The host interface has a higher priority than the AUX interface.
> - The user interface of the SOPAS ET configuration software refers to the AUX interface of the device as the "Auxiliary interface".

Host interface

The logical host interface of the device can operate the following interfaces in parallel:

- Serial data interface
- Host port of the Ethernet interface

The physical RS-232 and RS-422 host interfaces cannot be used concurrently.

▶ For output in real time, select one of the two ports of the Ethernet interface.

AUX interface

The logical AUX interface of the device can operate the following interfaces in parallel:

- Serial data interface
- USB interface
- AUX port of the Ethernet interface

Data output requested with command string

- Data output using a command string: Data output only occurs at the data interface on which the request was received.

6.4 Pin assignments of electrical connections

Connection 1
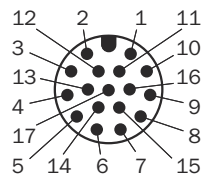
Figure 17: Male connector, M12, 17-pin, A-coding

Table 6: Pin assignment of the 1 connection (M12)

Pin	Signal	Function
1	GND	Ground
2	V_S	Supply voltage
3	CAN L	CAN bus (IN/OUT)
4	CAN H	CAN bus (IN/OUT)
5	TD+ (RS-422), Host	Host interface (sender+)
6	TD– (RS-422), Host TxD (RS-232), Host	Host interface (sender–)
7	TxD (RS-232), AUX	AUX interface (sender)
8	RxD (RS-232), AUX	AUX interface (receiver)
9	SensGND	Ground for digital inputs
10	Sensor 1	Digital input 1
11	RD+ (RS-422) Host	Host interface (receiver+)

Pin	Signal	Function
12	RD– (RS-422), host RxD (RS-232, Host	Host interface (receiver–)
13	Result 1	Digital output 1
14	Result 2	Digital output 2
15	Sensor 2	Digital input 2
16	N.c.	–
17	N.c.	–
–	–	Shielding

"Ethernet" connection
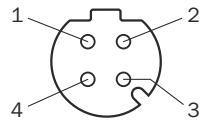
Figure 18: M12 female connector, 4-pin, D-coded

Table 7: Pin assignment of the "Ethernet" connection

Female connector	Signal	Function
1	TD+	Sender+
2	RD+	Receiver+
3	TD–	Sender–
4	RD–	Receiver–

Adapter cable, with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin
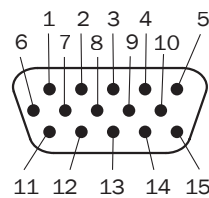
Figure 19: Male connector, D-Sub-HD, 15-pin

Table 8: Pin assignment (D-Sub-HD) of the adapter cable

Pin	Signal	Function
1	V_S	Supply voltage
2	RxD (RS-232), AUX	AUX interface (receiver)
3	TxD (RS-232), AUX	AUX interface (sender)
4	Sensor 2	Digital input 2
5	GND	Ground
6	RD+ (RS-422) Host	Host interface (receiver+)
7	RD– (RS-422), host RxD (RS-232, Host	Host interface (receiver–)
8	TD+ (RS-422), Host	Host interface (sender+)
9	TD– (RS-422), Host TxD (RS-232, Host	Host interface (sender–)

Pin	Signal	Function
10	CAN H	CAN bus (IN/OUT)
11	CAN L	CAN bus (IN/OUT)
12	Result 1	Digital output 1
13	Result 2	Digital output 2
14	Sensor 1	Digital input 1
15	SensGND	Ground for digital inputs

6.5 Instructions for electrical installation when the ambient temperature can fall below 0 °C

> **NOTE**
> For mounting instructions, see "Mounting instructions for ambient temperature range below 0 °C", page 25

All device variants can also be operated at low ambient temperatures. Details see "Ambient data", page 78 in the technical data.

6.5.1 Prerequisites

- Required supply voltage: see "Supply voltage", page 43
- Use SICK standard cables for the specified ambient temperature range.

> **NOTE**
> You will find the technical data for the cables on the product page.
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
> {P/N} corresponds to the part number of the product, see type label.
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

- Do not operate the device at ambient temperatures below 0 °C when mounting or connection work is being carried out.
- Perform all connection work only in the ambient temperature range 0 °C to +50 °C. Secure the connecting cables.
- The shared side cover of the USB interface and card slot must be screwed tight to the device.
- All cables connected to the device must be clamped. If the "Ethernet" port is not used, fit the port with a screw-on protective element, e.g., a protective cap, as delivered. The protective element is hand-tightened.
- When operating the device at the lower limit of the permissible ambient temperature range (see "Technical data", page 75), do not expose the device to strong air flows (e.g. ventilation system, wind).

6.5.2 Behavior of the device when switched on

After application of the supply voltage and successful initialization, the device can be addressed using the SOPAS ET configuration software.

Table 9: Behavior of the device when switched on at low temperatures

Housing internal temperature	Behavior
Below –25 °C	"Ready" LED continuously flashes yellow. Device is not operational because the temperature is below the specified minimum limit value of -25 °C (–30 °C [1]).

Housing internal temperature	Behavior
−25 °C (−30 °C [1]) ... −20 °C	"Ready" LED continuously flashes green (warm-up phase). Device is not operational (communication channel still disabled) until the internal temperature has increased to −20 °C as a result of the heat generated by the electronics. Duration approx. 2 minutes.
From -20 °C	"Ready" LED lights up green. The device has started regular operation.

[1] For Firmware Version V2.02

Once the supply voltage has been applied, the device uses integrated temperature sensors to measure its internal temperature. This is performed by the device while booting.

6.6 Connecting the supply voltage

6.6.1 Note on the supply voltage of the device

> **!** **NOTICE**
> **Risk of damage to the device due to reverse polarity of the supply voltage!**
> Reversing the polarity of the supply voltage may, under certain circumstances, damage the device due to short circuit currents!

The supply voltage input for the RFID device is designed with internal circuit protection to provide reverse polarity protection. For this purpose, there is a blocking diode in the current path of the positive pole (see figure).

The internal ground corresponds to the negative pole of the supply voltage for the device. The functional earth has a direct galvanic connection to the metal housing of the device for RF-related technical reasons.

Depending on the mounting location of the RFID device and the reference potential of the supply voltage, a reversal of the polarity of the applied supply voltage can lead to the following two situations:
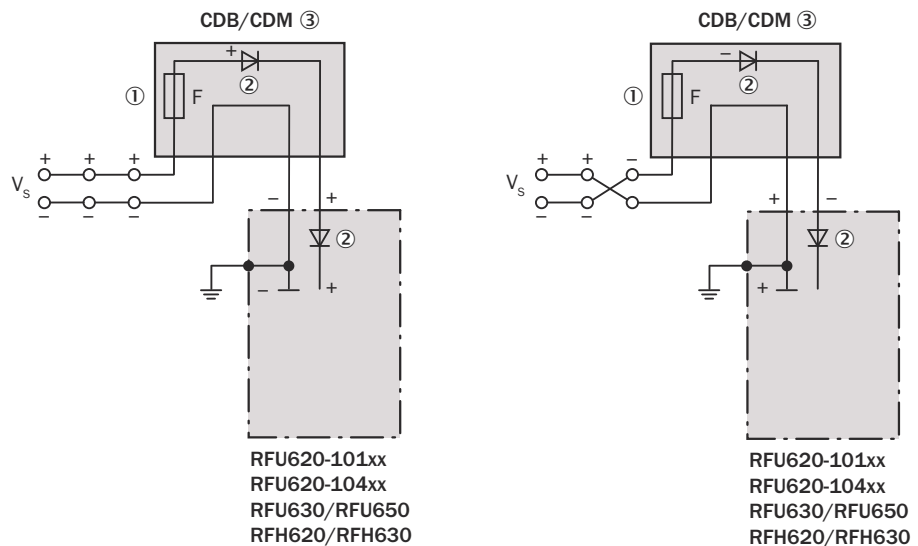
Situation 1

RFU620-101xx
RFU620-104xx
RFU630/RFU650
RFH620/RFH630

RFU620-101xx
RFU620-104xx
RFU630/RFU650
RFH620/RFH630

Figure 20: Reversal of the polarity of the supply voltage: no effect on the RFID device (see requirements)

①   Fuse in the connection module: 2 A (CDB650-204, CDM420-0006)

②   Blocking diode

③   Connection modules

The housing of the RFID device is connected to functional earth.

If the polarity of the supply voltage is reversed, the blocking diode blocks the negative voltage on the positive pole of the RFID device.

> **!**   **NOTICE**
>
> **The polarity reversal will not cause any damage provided the following two requirements are met for the device:**
> - The negative pole of the applied supply voltage is not connected to functional earth as a common reference potential.
> - The device is not connected in an electrically conductive manner to any other peripheral devices that use the same reference potential, neither through its metal housing or over other cables (signal relative to GND, shielding).
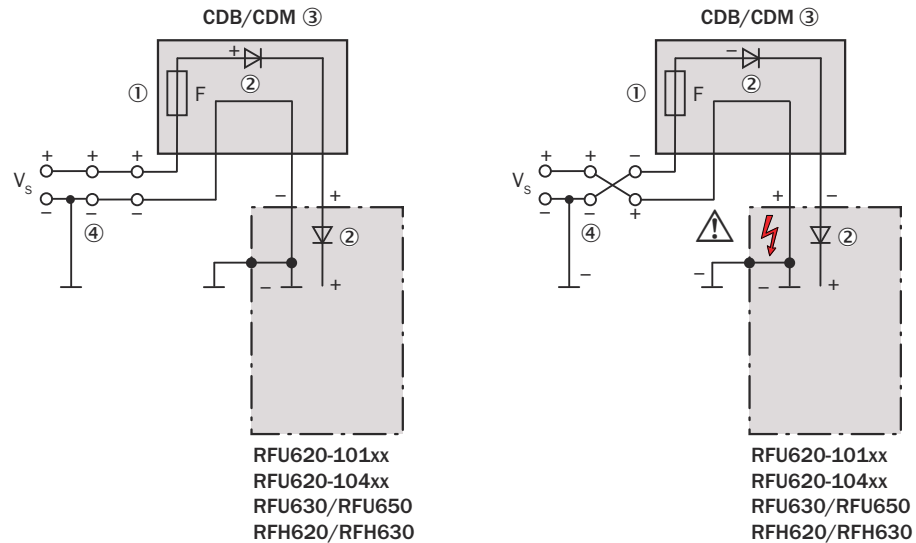
Situation 2

Figure 21: Reversal of the polarity of the supply voltage with common system GND: Risk of damage to the RFID device

①   Fuse in the connection module: 2 A (CDB650-204, CDM420-0006)

②   Blocking diode

③   Connection modules

④   Battery

The housing of the RFID device is connected (see figure) in an electrically conductive manner to the reference potential (system GND), which is also connected to the negative pole of the applied supply voltage. Typical mounting location: Vehicle with chassis as a common reference potential

> **!**   **NOTICE**
>
> If the polarity of the supply voltage is reversed, this can lead to short-circuit currents between the reversed positive and negative poles.

6.6.2   Supply voltage

The voltage source must meet the requirements of ES1 (EN 62368-1).

> **NOTE**
> **UL-certified devices** (see type label) require a supply voltage according to ES1, EN 62368-1, NEC protection class 2 (UL1310).

> **NOTE**
> **Required input voltage on connection module**
> The connection cable from the connection module to the device, and to a lesser extent the connection module itself, cause a voltage drop in the supply circuit. The magnitude of the voltage drop in the connection cable depends on the length of cable.
>
> When operating the device at the lower end of the supply range (18 V DC), the sum of these voltage losses needs to be compensated for.
>
> ► To do so, apply a higher input voltage to the connection module as per the following table.
>
> The voltage drops for a customer-specific connection or connection module have also been taken into account.

Table 10: RFU630/650: Required supply voltage V_S

Supply voltage V_S for device	Connection modules	Part no. Cable (length)	Wire cross-section supply voltage V_S	Voltage drop across the cable at DC 18 V/I = max. 1.35 A	Required minimum supply voltage V_S to the connection module	Fuse protection value for supply voltage V_S
18 V … 30 V DC [1] P = max. 26 W	CDB650-204	6052286 (2 m) 6051194 (3 m) 6051195 (5 m)	0.14 mm² 0.14 mm² 0.14 mm²	1.0 V 1.5 V 2.3 V	DC 19.0 V DC 19.5 V DC 20.3 V	CDB650-204 (2 A)
	CDM420-0006	2056184 (0.35 m) 2049764 (0.9 m) 2055419 (2 m) 2055420 (3 m) 2055859 (5 m) 2061480 (2 m) 2061605 (3 m) 2061481 (5 m)	0.10 mm² 0.10 mm² 0.10 mm² 0.10 mm² 0.10 mm² 0.14 mm² 0.14 mm² 0.14 mm²	0.2 V 0.5 V 1.0 V 1.5 V 2.5 V 1.0 V 1.5 V 2.3 V	DC 18.2 V DC 18.5 V DC 19.0 V DC 19.5 V DC 20.5 V DC 19.0 V DC 19.5 V DC 20.3 V	CDM420-0006 (2 A)
	Customer-specific wiring	6042772 (3 m) 6042773 (5 m) 6048817 (10 m) 2070425 (3 m) 2070426 (5 m) 2070427 (10 m) 6045141 (5 m) 6048319 (10 m)	0.14 mm² 0.14 mm² 0.14 mm² 0.14 mm² 0.14 mm² 0.14 mm² 0.14 mm² 0.25 mm²	1.5 V 2.3 V 4.6 V 1.5 V 2.3 V 4.6 V 2.3 V 2.0 V	DC 19.5 V DC 20.3 V DC 22.6 V DC 19.5 V DC 20.3 V DC 22.6 V DC 20.3 V DC 20.0 V	2 A at the start of the cable
12 V … 30 V DC [2] P = max. 26 W		6048319 (10 m)	0.25 mm²	3.0 V at DC 12 V / 1.9 A	DC 15.0 V	2.5 A at the start of the cable

[1] When operating the device via the optional SICK CDB650-204 or CDM420-0006 connection module and using a SICK connecting cable. When operating the device below 0 °C and using a cold-resistant connecting cable from SICK.

[2] When operating the device without a SICK connection module and using a SICK connecting cable. When operating the device below 0 °C, use the cold-resistant supply cable from SICK, part no. 6048319 (2 x 0.25 mm², 10 m).

• The power source must be able to deliver at least 26 W of power or at least 1.5 A at 18 V DC.

> **NOTE**
> The voltage supply via a power supply unit must be capable of buffering a brief power failure of 20 ms.

- In the case of connection via the optional CDB/CDM connection module: Additionally required output power 0.5 W when using the optional CMC600 parameter cloning module in the connection module.

Protecting the supply cables

To ensure protection against short-circuits and overload in the customer-supplied cables, the wire cross-sections used must be selected and protected in accordance with national regulations.

The following standards must be observed in Germany:

- DIN VDE 0100 (Part 430)
- DIN VDE 0298 (Part 4) or DIN VDE 0891 (Part 1)

Wiring without SICK connection module

Supply voltage 12 V to 30 V DC: when operating the device with the SICK supply cable part no. 6048319 (2 x 2.5 mm², length 10 m) protect the device with a separate 2.5 A slow-blow fuse.

▶ Install the fuse in the supply circuit at the start of the supply cable.

Wiring with SICK connection module

Supply the voltage to the device via a connection module:

Connection module	Interface	Reference
CDB650-204	Supply voltage	see "Connecting supply voltage for the device in CDB650-204", page 88
CDM420-0006	Supply voltage	see "Connecting supply voltage for the device in CDM420-0006", page 101

If the supply voltage is connected via a connection module, observe the respective operating instructions of the module used.

6.7 Wiring data interfaces

Wiring the Ethernet interface

1. Connect the device to the Ethernet interface of the computer via an adapter cable.
2. Set up communication via SOPAS ET configuration software.

---

i **NOTE**
The Ethernet interface of the device has an Auto-MDIX function. This automatically adjusts the transmission speed as well as any necessary crossover connections.

Wiring serial data interfaces

The maximum data transmission rate for the serial interface depends on the length of cable and on the type of interface. Observe the following recommendations:

Table 11: Serial interfaces: data transmission rates

Interface	Data transmission rate	Number of wires	Distance to the target computer (host)
RS-232	Up to 19.2 kBd 38.4 kBd ... 57.6 kBd 115.2 kBd ... 500 kBd	2 and Ground	Max. 10 m Max. 5 m < 2 m

Interface	Data transmission rate	Number of wires	Distance to the target computer (host)
RS-422 [1] [2] [3]	Up to 38.4 kBd 38.4 kBd ... 57.6 kBd 57.6 kBd ... 500 kBd	4 and Ground	Max. 1,200 m Max. 500 m Max. 10 m

[1] For RS-422-compatible cable and corresponding cable termination as per specification
[2] RS-422 operation only 4-wire and ground!
[3] When wiring via a CDB650 or CDM420-0006 connection module, operate the S6 switch in the connection module **only in the RS422 position**.

! NOTICE

Risk of damage to the internal interface modules

If the serial data interfaces are wired incorrectly, then electronic components in the device could get damaged.

- Observe the information on wiring.
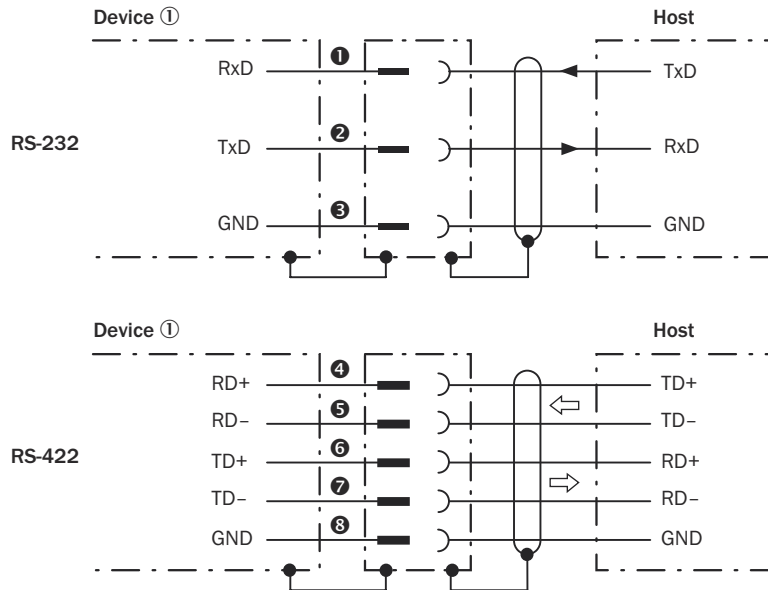- Carefully check the wiring prior to switching on the device.

Figure 22: Wiring of the serial data interfaces RS-232 and RS-422

①   Device
❶...❸ Pin assignment: see RS-232 pin assignment for the respective device
❹...❽ Pin assignment: see RS-422 pin assignment for the respective device

---

i NOTE

Activate the serial data interface type in the device using a configuration tool, e.g. the SOPAS ET configuration software.

Wiring the serial data interfaces of the device via a connection module:

Connection module	Data interface	Reference
CDB650-204	RS-232	see "Wiring serial host interface RS-232 of the device in CDB650-204", page 88
	RS-422	see "Wiring serial host interface RS-422 of the device in CDB650-204", page 89

Connection module	Data interface	Reference
CDM420-0006	RS-232	see "Wiring serial host interface RS-232 of the device in the CDM420-0006", page 102
	RS-422	see "Wiring serial host interface RS-422 of the device in the CDM420-0006", page 102

If the data interface is wired via a connection module, observe the respective operating instructions of the module used.

Termination of the RS-422 data interface

Implement the termination in the connection module via switches.

Additional information on this can be found in the operating instructions for the relevant connection module.

6.8 Wiring the CAN interface

NOTE

Activate the CAN data interface in the device with a configuration tool, e.g., the configuration software SOPAS ET.

Make further settings in the device corresponding to the function of the device in the system configuration.

Wiring the CAN interface of the device via a connection module:

Connection module	Data interface	Reference
CDB650-204	CAN	see "Wiring the CAN interface of the device in the CDB650-204", page 90
CDM420-0006	CAN	see "Wiring the CAN interface of the device in the CDM420-0006", page 103

NOTE

You will find more connection modules on the product page.

The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

If the CAN interface is wired via a connection module, observe the respective operating instructions of the module used.

6.9 Wiring digital inputs

Physical digital inputs on the device

The two physical digital inputs "Sensor 1" and "Sensor 2" can be used, for example, for starting and ending the external read cycle or for feeding an incremental signal.

The full complement of digital inputs is available in each case:

- At the male connector of the device (M12, 17-pin, A-coded)
- At the adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin
- At the open end of the adapter cable with female connector, M12, 17-pin, A-coded
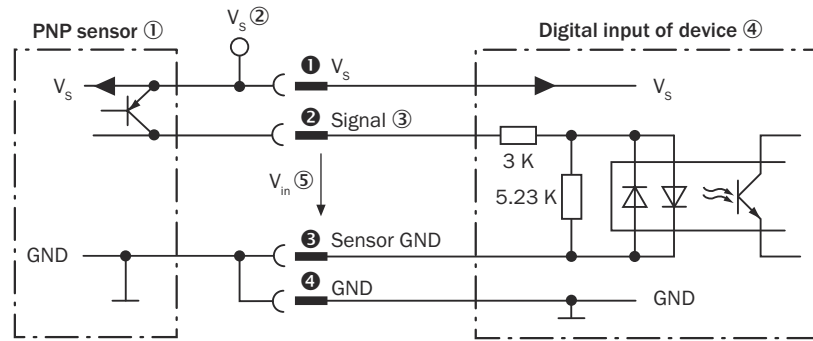
Figure 23: Wiring a digital input

①   Trigger sensor (PNP sensor)
②   Supply voltage V_S
③   Input signal
④   Digital input of the device ("Sensor 1" or "Sensor 2")
⑤   Input voltage V_{in}
❶... ❹ For pin assignment, see respective device

Table 12: Characteristic data of the digital inputs "Sensor 1" and "Sensor 2"

Type	Switching
Switching behavior	Power to the input starts the assigned function, e.g. start of the internal reading gate of the device. Default: active high, debounce time: 10 ms (standard)
Properties	• Opto-decoupled, reverse polarity protected • Can be wired with PNP output of a trigger sensor
Electrical values	The electrical values are identical for all digital inputs. Low: V_{in} [1] ≤ 2 V; I_{in} [2] ≤ 0.3 mA High: 6 V ≤ V_{in} ≤ 32 V; 0.7 mA ≤ I_{in} ≤ 5 mA

[1]   Input voltage.
[2]   Input current.

Optional: additional, external digital inputs in the connection module

The optional CMC600 parameter cloning module in combination with the Connection Device Basic or Connection Device Modular connection module offers two additional external digital inputs for the device.

In this case the physical digital inputs "External input 1" and "External input 2" are available at the respective terminals of the connection module. The CMC600 transmits the switching signals of the two external digital inputs to the device via its serial data interface. The device converts the switching signals internally into states of its logical inputs "External input 1" and "External input 2".

For the signal designations of the terminals of the two external digital inputs, see the connection diagrams for the connection modules in these operating instructions.

ⓘ **NOTE**
The external digital inputs are not suitable for time-critical applications.

Function assignment

ⓘ **NOTE**
Assign the functions for the external digital inputs in the device using a configuration tool, e.g., the SOPAS ET configuration software.

For the characteristic data of the two external digital inputs, see the respective connection diagrams for the connection modules in these operating instructions.

Wiring the digital inputs of the device via a connection module:

Connection module	Digital inputs	Reference
CDB650-204	"SENS/IN 1" "SENS/IN 2"	see "Wiring digital inputs of the device in the CDB650-204", page 92
	External input 1 ("EXT. IN 1") External input 2 ("EXT. IN 2")	see "Wiring the external digital inputs of the device in the CDB650-204", page 94
CMD420-0006	"Sensor 1" "Sensor 2"	see "Wiring digital inputs of the device in the CDM420-0006", page 105
	External input 1 ("AUX In 1") External input 2 ("AUX In 2")	see "Wiring the external digital inputs of the device in the CDM420-0006", page 106

If the digital inputs are wired via a connection module, observe the respective operating instructions of the module used.

6.10 Wiring digital outputs

Physical digital outputs on the device

The two physical digital outputs "Result 1" and "Result 2" signal events in the read operation. Different functions can be assigned to the outputs independently of each other for this purpose. If the assigned event occurs, then the corresponding digital output switches after the end of the read cycle for the selected pulse duration, for example (default).

The full complement of digital outputs is available in each case:

- At the male connector of the device (M12, 17-pin, A-coded)
- At the adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin
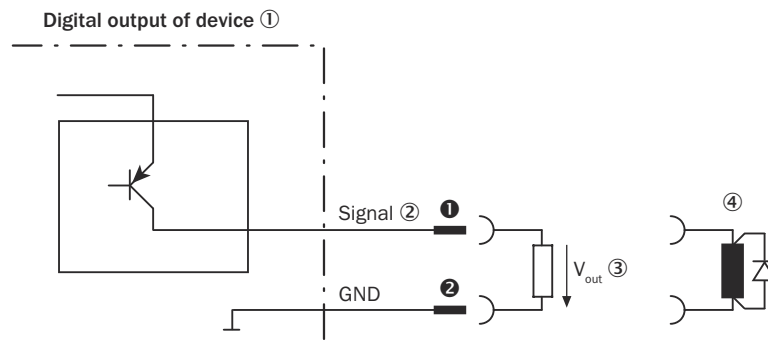- At the open end of the adapter cable with female connector, M12, 17-pin, A-coded

Figure 24: Wiring a digital output

①   Digital output of the device ("Result 1" or "Result 2")
②   Output signal
③   Output voltage V_{out}
④   With inductive load: see note
❶... ❷ For pin assignment, see respective device

Table 13: Characteristic data of the digital outputs "Result 1" and "Result 2"

Type	Switching
Switching behavior	PNP switching to supply voltage V_S Default: no function, logic: not inverted (active high)
Properties	• Short-circuit protected and temperature protected • Not electrically isolated from V_S
Electrical values	$0\ V \leq V_{out}$ [1] $\leq V_S$ [2] $(V_S - 1.5\ V) \leq V_{out} \leq V_S$ at I_{out} [3] $\leq 100\ mA$

[1] Output voltage.
[2] Supply voltage.
[3] Output current.

NOTE

Provide an arc-suppression switch at the digital output if inductive load is present.

► Attach a freewheeling diode directly to the load for this purpose.

Optional: additional, external digital outputs in the connection module

The optional CMC600 parameter cloning module in combination with the Connection Device Basic or Connection Device Modular connection module offers two additional external digital outputs for the device.

In this case the physical digital outputs "External output 1" and "External output 2" are available at the respective terminals of the connection module. The device transmits the logical states of its two external outputs to the CMC600 via its serial data interface. The CMC600 converts the logical states into switching signals of the physical digital outputs "External output 1" and "External output 2".

For the signal designations of the terminals of the two external digital outputs, see the connection diagrams for the connection modules in these operating instructions.

NOTE

The external digital outputs are not suitable for time-critical applications.

Function assignment

NOTE

Assign the functions for the digital outputs in the device using a configuration tool, e.g. the configuration software SOPAS ET.

For the characteristic data of the two external digital outputs, see the connection diagrams for the connection modules in these operating instructions.

Wiring the digital outputs of the device via a connection module:

Connection module	Digital outputs	Reference
CDB650-204	"RES/OUT 1" "RES/OUT 2"	see "Wiring digital outputs of the device in the CDB650-204", page 95
	External output 1 ("EXT. OUT 1") External output 2 ("EXT. OUT 2")	see "Wiring the external digital outputs of the device in the CDB650-204", page 97

Connection module	Digital outputs	Reference
CDM420-0006	"Result 1" "Result 2"	see "Wiring digital outputs of the device in the CDM420-0006", page 108
	External output 1 ("Aux Out 1") External output 2 ("Aux Out 2")	see "Wiring the external digital outputs of the device in the CDM420-0006", page 110

If the digital outputs are wired via a connection module, observe the respective operating instructions of the module used.

7 Commissioning

7.1 Installation steps

7.1.1 Wiring the device for Quickstart

> **i** **NOTE**
> The numbering of the data interfaces (Host 1, AUX 1) in the following block diagrams is intended to provide a better overview. The numbering is not shown in configuration tools, e.g. in the SOPAS ET configuration software.
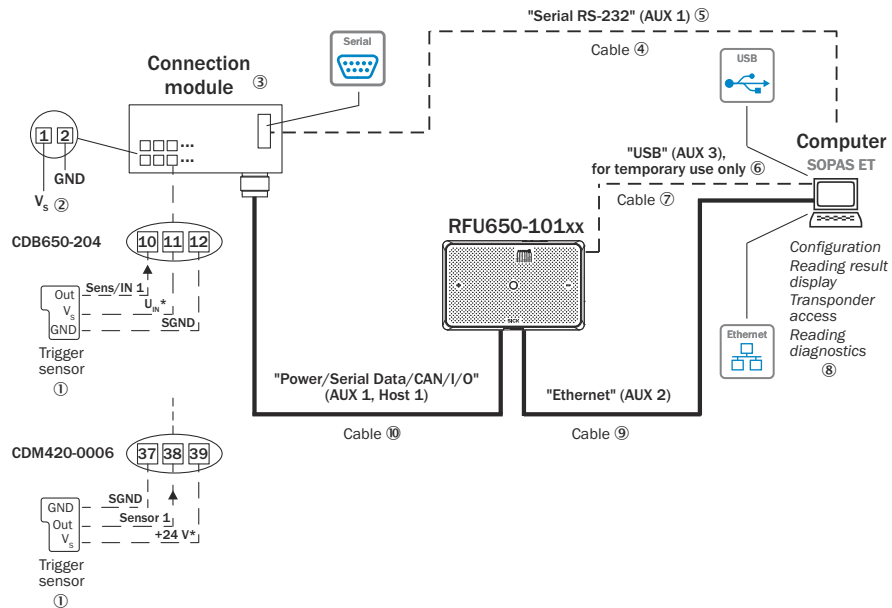

Figure 25: Electrical connection block diagram for the RFU650-101xx with optional connection module: commissioning

① Trigger sensor for external read cycle

② Supply voltage V_S

③ Connection module CDB650-204 or CDM420-0006

④ Null modem cable with two female connectors, D-Sub, 9-pin, crossed TxD and RxD

⑤ Serial RS-232, alternative to USB or Ethernet AUX port

⑥ USB, alternative to Ethernet AUX port. The USB interface must only be used temporarily as a servicing interface.

⑦ Adapter cable with male connector, USB, type Micro-B and male connector, USB, type A

⑧ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics

⑨ Adapter cable with male connector, M12, 4-pin, D-coded and male connector, RJ-45, 8-pin

⑩ For CDB650-204: Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded

For CDM420-0006: Adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin

Procedure:

Procedure

1. Connect the communication interface (e.g., Ethernet) of the device directly to the computer using cable ⑨.

2. Connect "Connection 1" (male connector, M12, 17-pin, A-coded) to the corresponding female connector on the connection module using cable ⑩.

3. If necessary, connect a trigger sensor for the external read cycle, such as a photoelectric retro-reflective sensor, to the "Sens/IN 1" (CDB650-204) or "Sensor 1" (CDM420-0006) digital input of the connection module. For CDB650-204: see "Wiring digital inputs of the device in the CDB650-204", page 92. For CDM420-0006 see "Wiring digital inputs of the device in the CDM420-0006", page 105.

4. Supply the device with the required voltage depending on the length of the connecting cable ⑩. see "Supply voltage", page 43.

✓ After successful initialization, the "Device Ready" LED lights up green.

5. Switch on computer.

6. Start Windows.

7.1.2 Block diagram: wiring the optional connection module

> **ℹ️ NOTE**
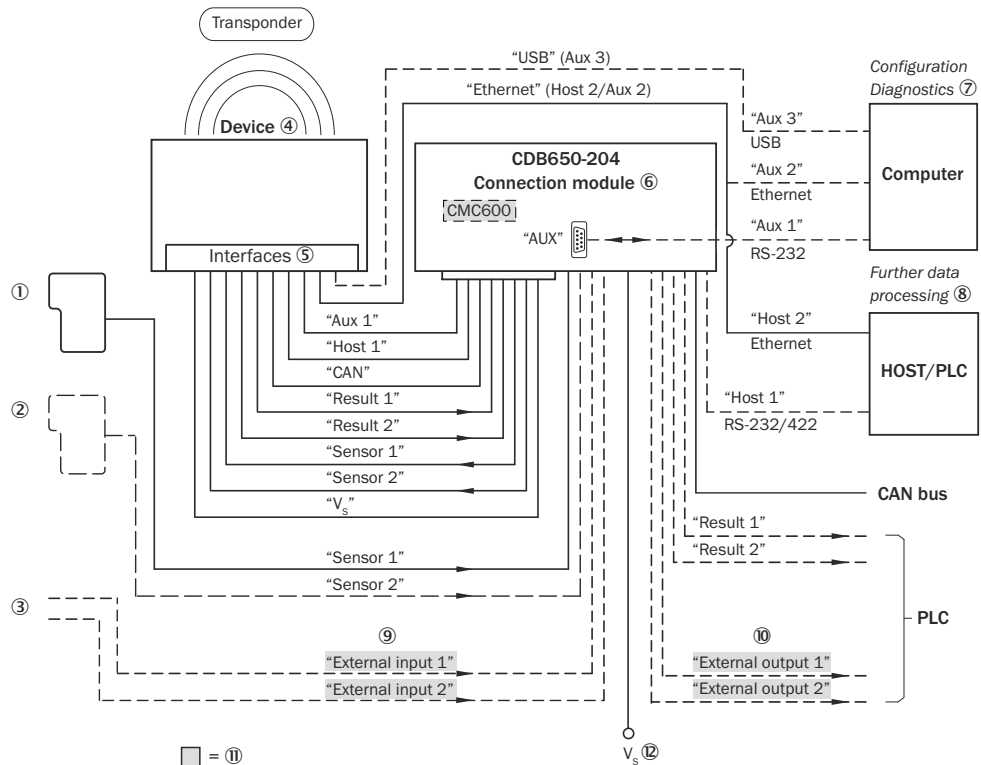> For possible combinations of the device and various connection modules, see table 14, page 54

Figure 26: Connection of the device to peripherals via CDB650-204 (overview)

① Start and stop reading pulse (e.g., photoelectric retro-reflective sensor)

② Application-dependent alternative stop read cycle (e.g. photoelectric sensor) or travel increment (incremental encoder)

③ Other functions

④ Device

⑤ Interfaces

⑥ Connection modules

⑦ Configuration and diagnostics

⑧ Data further processing

⑨   External digital inputs

⑩   External digital outputs

⑪   The parameter cloning module CMC600 is required to use the additional digital inputs and outputs of the device (highlighted in gray).

⑫   Supply voltage V_S

Using optional connection modules

Table 14: Possible combinations of device and connection modules

Device	Connection on the device	Connection module	Connection cable
RFU650	Male connector, M12, 17-pin, A-coded	CDB650-204	Cable 1:1 [1]
		CDM420-0006, CDM420-0007 [3]	Adapter cable [2]

[1]   Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded

[2]   Adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin

[3]   CDM420-0007: for connecting 2 devices

The supply voltage for the device is protected as follows in the connection modules:

Connection module	Number of connectable devices	Fuse rating
CDB650-204	1	1 x 2 A
CDM420-0006	1	1 x 2 A
CDM420-0007	2	2 x 2 A

The fuse is located in the "secondary" circuit after the switch S1.

ℹ️ **NOTE**

Connection diagrams for the connection modules

The connection diagrams can be found in the appendix of these operating instructions.

ℹ️ **NOTE**

Connection modules

Detailed information on mounting and electrical installation can be found in the operating instructions for the respective connection module.

You can find the operating instructions on the product page.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

ℹ **NOTE**
Wiring the signals without a SICK connection module

▶ When using a customer-supplied connection unit, refer to the relevant connection diagrams and descriptions for the basic methods for wiring the signals.

- see "Connecting the supply voltage", page 42
- see "Wiring data interfaces", page 45
- see "Wiring the CAN interface", page 47
- see "Wiring digital inputs ", page 47
- see "Wiring digital outputs ", page 49

- An alternative adapter cable for free wiring with female connector, M12, 17-pin, A-coded and open end is available.

ℹ **NOTE**
You can find adapter cables on the product page.

The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

7.2 Overview of the Commissioning Steps

The device is configured using a configuration tool. During initial commissioning, this is normally done use the SOPAS ET configuration software.

Other configuration tools are also available, for example a web server or command strings, depending on the task. For more information, see "Operating options and configuration tools", page 66.

Procedure
- Install the SOPAS ET configuration software and the required device description file on a computer
- Electrically connect the device to the computer
- Commission the device with the help of the "Quickstart" function in SOPAS ET. Use the factory defaults as the basis for this.
- Perform a manual fine adjustment and configuration of the device to optimize the functionality for the specific situation on site (reading and writing)
- Test the device for correct functioning in operational use.

7.3 SOPAS ET configuration software

The SOPAS ET configuration software is normally used to adapt the device to the reading situation on site. The optimized configuration data are then permanently saved to the device using the "permanent" option. The data can also be stored on the computer as a parameter set (project file) for archiving purposes.

The device can also permanently access the parameter set from an optional external storage medium. This makes it easier to replace the device if necessary.

A device-specific microSD memory card, or the CMC600 parameter cloning module in the Connection Device Basic or Connection Device Modular connection module are available for this purpose. For more information, see "Information on initial commissioning", page 60.

7 COMMISSIONING

7.3.1 Functions of the SOPAS ET configuration software (overview)

> **NOTE**
> The manual for the SOPAS ET configuration software describes the general functions in the program as well as the user interface.

- Selecting the menu language
- Setting up communication with the device
- Password-protected configuration for different operating levels
- …

The SOPAS ET configuration software provides the following functions, amongst others, relating to the device:

- Quickstart function with continuous read cycle triggering to demonstrate the transponder recognition and data display
- Access to the transponder content (reading and writing)
- Management of device apps
- Assistant for targeted configuration of the transponder read operation (Single Tag ID Wizard)
- Recording of device and communication data during operational use via the diagnostics log file output
- System diagnostics

7.3.2 Installing SOPAS ET and the device description file

> **NOTE**
> Depending on the situation on site, administrator rights may be required on the computer to install the software. The computer must provide a functioning Internet connection.

The SOPAS ET configuration software, the current system prerequisites for installing the software on the computer, and downloading instructions can be found online at:
www.sick.com/SOPAS_ET

1. Connect one of the data interfaces of the device to the computer.
   Recommended: Ethernet interface or USB interface
2. Switch on the supply voltage for the device.
3. Start computer.
4. Download and install the following components as per the instructions on the product page of the software:
   a) Current version of the SOPAS ET configuration software.
      In this case, select the "Complete" option as suggested by the installation wizard.
   b) Required current device description file (*.sdd) for the device
5. If the installation of the configuration software does not start automatically, run setup.exe in the download folder.
6. Follow the operating instructions to complete the installation.

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Subject to change without notice

7.3.3 Connecting the SOPAS ET configuration software to the device

1. Start the "SOPAS ET" program option after completing the installation.
   Path: Start > Programs > SICK > SOPAS ET Engineering Tool > SOPAS.
   By default, the software automatically searches for connected devices via the Ethernet, USB, and RS-232 interfaces.
2. Establish a connection between SOPAS ET and the device using the automatically launched wizard. Access via the Ethernet interface.
   To do so, select the relevant device in the list of available devices (default Ethernet address: IP address: 192.168.0.1, subnet mask: 255.255.255.0).
✓ SOPAS ET establishes communication with the device and loads the associated device description file. The **Quickstart** tab opens.

7.4 Quickstart with default settings

The purpose of the **Quickstart** function in the SOPAS ET configuration software is to make it simple and easy to obtain first transponder read results using the device. In this operating mode, the device displays all compatible transponders in its detection range based on the current device settings. During initial commissioning, this occurs using the default parameter settings for the device.

> **ⓘ NOTE**
> The "Quickstart" function is not intended to be used during normal operation.
>
> ▶ For operational use, select a read cycle using the object trigger control in SOPAS ET.

To use Quickstart, all mounting and electrical installation work must be complete (see the relevant sections in these operating instructions).

7.4.1 Detecting a transponder in Quickstart mode

> **ⓘ NOTE**
> The individual transponders must have a different UII/EPC so the device can identify multiple UHF transponders.

1. Bring one or more standards-compliant UHF transponders into the working range of the integrated antenna of the device.
2. Click the **Start** button on the **Quickstart** tab of SOPAS ET. SOPAS ET continuously generates an automatic read cycle and lists the identified transponders one after another in the Quickstart window.
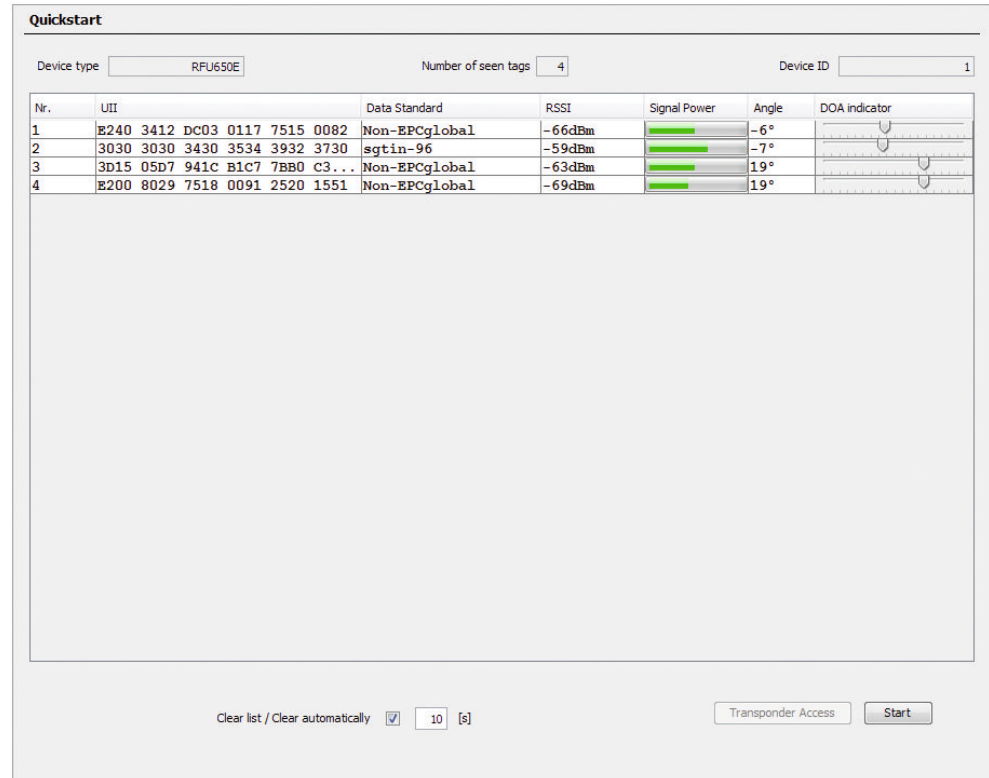
*Figure 27: SOPAS ET display of the detected transponders in the **Quickstart** window*

Feedback about transponder detection in the UHF field

In Quickstart mode, the default lighting behavior of the process feedback LEDs indicates whether a UHF field is present and whether the device has detected transponders.

The process feedback LED is in the center of the device front plate, and in this case, lights up blue.

Table 15: Process feedback LED

LED status	Status
At half brightness:	
Permanently on	UHF field available, no transponder in the field
At full brightness:	
Flashing slowly (f = 1.25 Hz)	1 transponder in field
Flashing quickly (f = 2.5 Hz)	2 transponders in the field
Flashing faster (f = 5 Hz)	More than 2 transponders in field

7.4.2 Accessing the data on a transponder

1. In order to access the memory area of a transponder, click the **Stop** button in **Quickstart**.
2. Highlight the desired transponder (click it with the mouse).
3. Click the **Transponder Access** button. The **Transponder Management Access** tab displays the content of the selected transponder.

*Figure 28: SOPAS ET: **Transponder Access** display window*

> **i** **NOTE**
> The device cannot write the TID (tag identifier) of the transponder.

7.4.3 Continuing the configuration

1. Under SOPAS ET in the left-hand navigation tree, edit the required tabs for the application using the additional entries under **Parameters**.
   These include amongst others:
   - ○ antenna configuration, performance optimization, data pre-processing, transponder processing
   - ○ Object trigger control (e.g. via digital input "Sensor 1"), data processing and data output
   - ○ Data output interface(s), function of the digital inputs and digital outputs, and use of an optional memory card if applicable
2. Set the transmitting power for the integrated (internal) antenna using sliders on the **Antenna Configuration** tab.
   - ○ The maximum permissible transmitting power for the integrated antenna is region-dependent, see Technical Information RFU65x Regulatory Compliance Information.

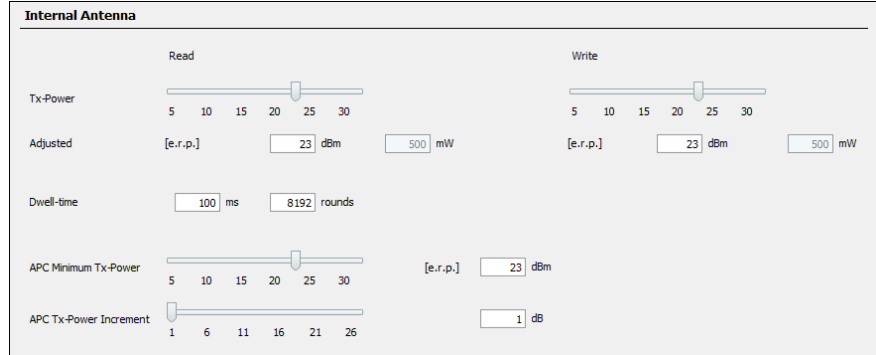○ Transmitting power default: 23 dBm (200 mW)

Figure 29: SOPAS ET: Example setting for the integrated antenna of the RFU65x

3. Test the configured settings during operational use of the system. Modify the settings if necessary.

7.4.4 Completing the configuration

► Permanently save the entire configuration once it has been successfully tested:
   ○ Parameter set in the device: Click the button 🖫 .
   ○ Configuration file on the computer: Click the buttons **Device > Export SDV file**.

7.5 Information on initial commissioning

The SOPAS ET configuration software on the computer is used to adapt the device to the particular application on site. The default factory settings of the device are the starting point for this. The default settings can also be accessed again after parameterization has been completed.

The parameter values (configuration data) in the working memory of the device can be modified to optimize the functionality of the device. This is done by creating an application-specific, further modifiable parameter set using SOPAS ET. The parameter set with the current configuration data is then loaded into the permanent parameter memory of the device.

> **NOTE**
> Recommendation: As part of a data backup plan, also save the current parameter set outside the device memory. This makes it easier, if necessary (device failure, etc.), to restore, to a replacement device of the same type, the current parameter set used to date.
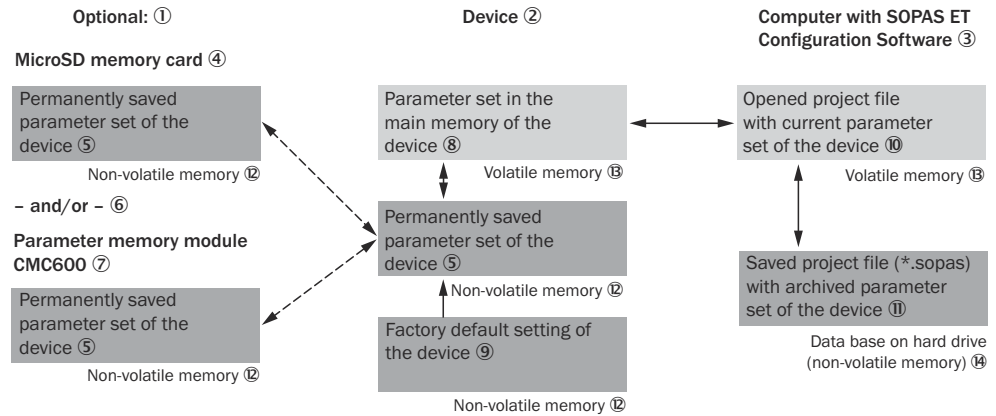
Memory organization for parameter set

Figure 30: Saving the parameter set and configuration using SOPAS ET

①   Optional

②   Device

③   Computer with SOPAS ET configuration software

④   MicroSD memory card

⑤   Permanently saved device parameter set

⑥   and/or

⑦   CMC600 parameter cloning module

⑧   Parameter set in the working memory of the device

⑨   Factory-set defaults for the device

⑩   Opened project file with current device parameter set

⑪   Saved project file (*.sopas) with archived device parameter set

⑫   Nonvolatile memory

⑬   Volatile memory

⑭   Data base on the hard drive (non-volatile memory)

External data backup: option 1

To back up the configuration data outside the device memory, **manually** save the current parameter set to the computer as a project file (sopas file). This is the generally recommended procedure.

External data backup: option 2

The prerequisite for **automatically** backing up the current parameter set data outside the device memory is to have an additional external storage medium. The device can optionally be permanently connected to an external parameter memory for this purpose.

a)   By inserting a microSD memory card with sufficient storage capacity into the device.

b)   By connecting the device to a connection module. By equipping the connection module with a CMC600 parameter cloning module. The CMC600 can be used in a CDB650-204 or CDM420-0006 connection module.

c)   By connecting the device to a CDF600 fieldbus module. By operating the device in proxy mode.

d)   By using a combination of a) plus b) or c)

Operating principle

Save the current parameter set to the permanent parameter memory of the device using the "permanent" option. The device then automatically also saves the parameter set to an external, permanent parameter memory.

Depending on the memory module used:
- To the memory card
- In the CMC600
- In the CDF600
- In both storage media using one of the possible combinations

At each restart after being switched on, the device loads the compatible parameter set from the external storage medium into its working memory and into its internal, permanent parameter memory. The parameter set is loaded either from a memory card or, depending on the configuration, from the CMC600 or CDF600.

At each restart after being switched on, the device loads the compatible parameter set from the external storage medium into its:
- Random Access Memory
- Internal, permanent parameter memory.

The parameter set is loaded either from a memory card or, depending on the configuration, from the CMC600 or CDF600.

At each restart after being switched on, the device loads the compatible parameter set from the external storage medium into its working memory and into its internal, permanent parameter memory. The parameter set is loaded either from a memory card or, depending on the configuration, from the CMC600 or CDF600.

> **NOTE**
> When using both a memory card and CMC600 or CDF600, the device will preferentially load the parameter set from the CMC600 or CDF600.

In the event of device failure, for example, this approach enables the device to be quickly and easily replaced with another device of the same type provided the above prerequisites have been met. This is achieved without any loss of configuration data, and without having to connect the computer to the SOPAS ET configuration software.

Memory card

> **NOTE**
> Only use types approved by SICK to ensure reliable function of the memory card.

> **NOTE**
> Memory cards can be found on the product page.
> The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}
> {P/N} corresponds to the part number of the product, see type label.
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

8 Operation

8.1 Operating and status indicators
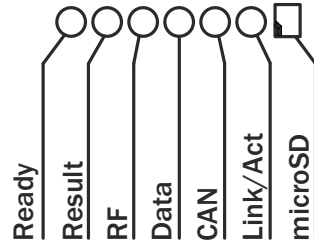
8.1.1 Optical status indicators on the display panel

Table 16: Function of the status indicators

Display	Color	Behavior LED	Device status
Ready	-	○	Device without supply voltage
After switching on supply voltage:			
Ready [1]	Orange	☀ [2]	Device is not ready for use: The internal temperature of the device is below -25 °C(-30 °C [3]).
	Green	☀ [2]	Warm-up phase of the device: For ambient temperatures below –20 °C: Internal temperature of the device is between -30 °C and -20 °C. The device starts normal operation after approx. 2 minutes.
Normal operation:			
Ready	Green	●	Device is ready for use.
	Red	●	Device is not ready for use: Hardware error
RF	Green	●	UHF field is switched on.
	Red	●	Possible causes: • Fault: Internal antenna or HF part. Error, for example reflective, received power too high
Result	Green	●	Read or write successful.
Data output at the serial host interface:			
Data [3]	Green	●	Data traffic via the host interface
Data traffic on the CAN bus:			
CAN [3]	Orange	●	Data traffic via CAN bus (CAN RX)
Data transmission at the Ethernet interface:			
Link/Act	Green	●	Data traffic via the Ethernet interface
PROFINET operation with single port:			

Display	Color	Behavior LED	Device status
Ready	Green Red	☀ ☀	**The LED flashes cyclically, alternating 4 times red, 1 time green.** • The device attempts to establish a connection to a PLC (IO controller) – or – • During operation: The connection between the device and the PLC (IO controller) is interrupted, either logically or electrically For display behavior and device status, see the following table "PROFINET operation (single port)".
Memory card:			
microSD	-	○	Memory card not inserted.
	Green	●	Memory card is inserted and ready for use. • In this state, the device can either write data to the memory card or read data on the card. • If the LED lights up, however, this does not indicate that the device is actually accessing the memory card.
	Red	●	Memory card inserted, but the device cannot read any data. Possible causes: • Memory card does not contain data • Content is not readable • Memory card is defective

○ = LED off, ● = LED is lit, ☀ = LED flashes
[1] Ready LED consists of green, yellow and red components.
[2] Flash frequency 1 Hz.
[3] For firmware version V2.02 or higher.

PROFINET operation (single port):

The **Ready** status LED signals the device status in the PROFINET network.

Ready LED		Device status	Remarks
Green components	Red components		
●	○	Device is ready for use.	
●	☀ Flashes every 0.5 seconds.	PROFINET is activated in the device. The device is not connected to the PROFINET IO controller (PLC) or the device is not configured.	To not use PROFINET, deactivate PROFINET. In the default configuration of the device, automatic PROFINET network detection is activated. This detects during startup whether the device is in a PROFINET environment and activates PROFINET automatically. To prevent this, deactivate PROFINET network detection or set the device name different to the default. To apply the changed settings, permanently save the changes and restart the device.

Ready LED		Device status	Remarks
Green components	**Red components**		
☀	☀	The **flashing** function is activated via the configuration software.	The red and green components of the LED flash alternately. Prerequisite: PROFINET is activated in the device.

● = lights up; ☀ = flashes; ○ = does not light up

8.1.2 Optical "process feedback" status indicator

The "Process Feedback" status display operates with one LED. The LED is located in the center of the antenna hood, see "Device view", page 15.

The behavior of the indicator (color, brightness, activation condition) can be configured.

The following activation conditions can be selected:

- Successful process of transponder handling. The process consists of: triggering and subsequent reading, if applicable also writing of transponder data.
- External SOPAS ET command, script
- A pre-defined or application-defined evaluation condition has occurred

ℹ **NOTE**
Select the activation condition and brightness using a configuration tool, for exampleSOPAS ET configuration software. The display can be deactivated.

Operating mode: Quickstart

This operating mode for detecting transponders in the UHF field is intended for demonstration purposes and for getting familiar with the operation of the device. In this mode, the device automatically generates continuous read cycles. Contrary to normal read operation (object-related read cycle triggering), the status indicator provides continuous feedback on the success of the transponder detection.

Table 17: Function of the "process feedback" status indicator in Quickstart mode

Color	Behavior	Status
Blue	Lights up at half brightness	UHF field available, no transponder in the field
Blue	Flashes at full brightness: Flashing slowly (f = 1.25 Hz)	1 transponder in field
	Flashing quickly (f = 2.5 Hz)	2 transponders in field
	Flashing faster (f = 5 Hz)	More than 2 transponders in field

The color of the indicator, and the brightness of the status indicator in Quickstart mode cannot be modified.

ℹ **NOTE**
The "Quickstart" function is not intended to be used during normal operation.

▶ For operational use, select a read cycle using the object trigger control in SOPAS ET.

Operating mode: Read mode

Table 18: Function of the "process feedback" status indicator in read mode

Color	Behavior	Status
Blue	Lights up for the duration of the in-progress reading interval	Read operation was started by an external or internal trigger source, device has started an internal reading interval (event)
Green	Lights up briefly	Device has ended the internal reading interval. Transponder detected and optionally selected condition(s) met -> Good Read (event)
Red	Lights up briefly	Device has ended the internal reading interval. Transponder not detected or optionally selected condition(s) not met -> No Read (event)
Direction of movement of the transponder in the UHF field:		
Cyanogen	Lights up briefly	Passage direction: From plus (+) to minus (-)
Pink	Lights up briefly	Passage direction: From minus (-) to plus (+)

8.1.3 Operating options and configuration tools

NOTE

In addition to the existing operating instructions, the use of the RFU parameter description is recommended:
- This parameter description explains the UHF-RFID-specific parameters of all device variants of the RFU6xx product family up to and including the "Service" user level.
- The parameter description assists with setting up applications using the SOPAS ET configuration software.

The parameter description is available in English (part no. 8023085) and German (part no. 8023084) as well as other languages if required.

NOTE

The parameter description can be found on the product page.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

The device can be operated and configured in the following 5 ways for specific tasks:

1. SOPAS ET configuration software

- Standard configuration tool for the device
- The configuration software and appropriate device description file are installed on a computer. These are available online at: **www.sick.com/SOPAS_ET**
- Password-protected configuration at four different operating levels (user levels):

Level	User levels	Note
1	Operator	No entry of password required, no configuration possible
2	Maintenance personnel	Entry of password required
3	Authorized client	
4	Service	

NOTE
The two user levels "Run" and "Maintenance" are only password protected if the "Parameterization is password-protected" parameter in SOPAS ET is activated.

By default, logging into the device accesses the "Authorized client" user level. This requires the entry of a password.

- Type-dependent access to the device using the configuration software via:
  - Local data interface on the device
  - Ethernet network
- Backup of the parameter set to a location outside the device memory:
  - Manually to a configuration file on the computer
  - Semi-automatically to optional external storage media (microSD memory card or CMC parameter cloning module)
- Access to the device via the AUX or host interface
- Organization of the device constellation into projects (stand-alone device or group of devices via a CAN network)
- The configuration software is used for device diagnostics in case of a fault.
- The configuration software supports firmware updates for the device

2. Integrated SOPASair web server

- No installation of configuration software required, an Internet-capable HTML browser is sufficient. Access to the device by entering an IP address
- No administrator rights required, no firewall restrictions.
- Web server runs directly on the device being contacted (embedded in the firmware).
- Access only via the Ethernet interface and by entering the IP address of the device
- Access locally on the device or via the network
- Used to configure a stand-alone device.
- Password-protected configuration at four different operating levels. Naming of the user levels, in English only here:

Level	User levels	Note
1	Run	No entry of password required, no configuration possible
2	Maintenance	Entry of password required
3	AuthorizedClient	
4	Service	

- Has limited functionality compared to the SOPAS ET configuration software. The functionality of the web server depends on the firmware version of the device.

3. Command strings (telegrams)

- Command strings (CoLa) are used to configure device parameters and trigger device functions (e.g. reading).
- Command strings can be entered in telegram style at one of the available data interfaces (AUX or host interface) of the device. The telegram response of the device to the command is always sent to the interface on which the telegram was received. In contrast to this, the read result data can be outputted to all data interfaces except for the USB interface.
- The communication between the SOPAS ET configuration software and the device can be monitored and recorded via the terminal emulator in SOPAS ET. Commands can also be sent to the device. For more details on using the terminal, see the SOPAS ET manual.

- Documents listing and describing the available commands strings can be obtained from SICK on request.

> ⚠ **NOTICE**
> Both the command strings and the SOPAS ET configuration software are based on a command language. The command language directly accesses the command interpreter of the device. The command language must therefore be used with care, as the commands received by the device are executed immediately.
>
> Parameter values modified by means of commands are initially only active in the current parameter set in the volatile working memory of the device. To permanently save the modified parameter set, it needs to be copied to the non-volatile parameter memory using the relevant command. This ensures the changes are not lost when the supply voltage to the device is switched off.
>
> Any changes to the parameter values in the device made using command strings will only appear in the SOPAS ET configuration software after the following actions:
> - An upload of the current parameter set from the device, or
> - A synchronization between the device and SOPAS ET

4. Control software of a PLC controller

- The controller of a fieldbus (e.g. PLC) configures the device. For a PROFINET controller, for example, this is done via PROFINET by means of GSD parameterization. Backup of the parameter set as a configuration file in the PROFINET controller. The controller reconfigures the device at every PROFINET restart.
- Integrating the device into the most important fieldbus systems is made simpler with SICK function blocks for the relevant bus controller.

> ⓘ **NOTE**
> You will find SICK function blocks for various types of PLC from different manufacturers on the product page.
>
> The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}
>
> {P/N} corresponds to the part number of the product, see type label.
>
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

- The function blocks are based on command strings (CoLa).

5. SICK AppStudio development environment

- Used, for example, to implement application-specific data output protocols for the device. Based on functionalities already pre-installed in the programmable device.
- The app programmed using SICK AppStudio is loaded onto the device as a sensor app.
- More information is available online at: **www.sick.com/SICK_AppStudio**

9 Maintenance

9.1 Maintenance plan

During operation, the device works maintenance-free.

Depending on the assignment location, the following preventive maintenance tasks may be required for the device at regular intervals:

Table 19: Maintenance plan

Maintenance work	Interval	To be carried out by
Check device and connecting cables for damage at regular intervals.	Depends on ambient conditions and climate.	Specialist
Clean front of the device and external antennas, e.g. to remove metal dust.	Depends on ambient conditions and climate.	Specialist
Check the screw connections and plug connectors.	Depends on the place of use, ambient conditions or operating requirements. Recommended: At least every 6 months.	Specialist
Check that all unused connections are sealed with protective caps.	Depends on ambient conditions and climate. Recommended: At least every 6 months.	Specialist

9.2 Cleaning

> **!** **NOTICE**
> **Equipment damage due to improper cleaning.**
> Improper cleaning may result in equipment damage.
>
> - Only use recommended cleaning agents and tools.
> - Never use sharp objects for cleaning.

▶ If it is dirty (e.g., metal dust), clean the front of the device carefully using a soft, damp cloth (with a mild cleaning agent) in order to achieve the full read and write speed.

▶ The device must be cleaned regularly from the outside to guarantee heat dissipation and therefore operation. Particular attention must be paid to ensure that the cooling ribs and, if present, the fan are free from dust and dirt. Use a dry cloth or an industrial vacuum cleaner for cleaning. Do not use cleaning agents.

10 Troubleshooting

10.1 Overview of Potential Errors and Faults

⚠ **WARNING**
Risk of injury due to damage to the device!

For reasons of safety, if a device shows visible signs of damage do not put it into operation, or take it out of operation immediately.

Possible damage (depending on type):
- Housing: cracking, splitting or fracture
- Electrical connections (male connector or female connector): cracks or detachment from the housing

Table 20: Errors and faults

Situation	Error/ fault
Mounting	▪ Device poorly aligned to the objects with transponders (e.g. faults due to metal surfaces located next to the device) ▪ Damping materials between the device and transponders, e.g. liquids ▪ Trigger sensor for read cycle generation positioned incorrectly. Possible cause: e.g., internal reading gate in the device is opened too late or closed too early.
Electrical installation	▪ Supply voltage too low or incorrect polarity ▪ Data interfaces of the device wired incorrectly ▪ Digital inputs or digital outputs incorrectly wired
Configuration	▪ Functions not adapted to local conditions, e.g., parameters for the data interface not set correctly ▪ Device limits not observed, e.g. working range of the antenna
Operation	▪ Ambient temperature too low or high ▪ Read pulse control not suitably configured for the object(s) in the working range. ▪ Device faults (hardware/ software)

10.2 Detailed fault analysis

10.2.1 LEDs on the device

The status displays of the device can indicate possible faults or errors, see "Optical status indicators on the display panel", page 63.

10.2.2 System information

The device reports any errors that occur in a number of ways. The error output is hierarchical. This hierarchical structure allows for an increasingly detailed level of analysis:

- Communication errors can occur when transmitting telegrams (e.g. commands) to a data interface of the device. The device then returns a fault code on the same data interface.
- For errors that occur during reading, the device writes errors codes in the status log (see "Status log", page 71).

10.3 Status log

> **NOTE**
> The status log is retained even after switching the device off and on again.

The device distinguishes between four types of faults:

- Information
- Warning
- Fault
- Critical fault

The device saves only the last five entries for each fault type.

10.3.1 Displaying the Status Log

To display the status log, connect the SOPAS ET configuration software with the device online.

1. Connect the SOPAS ET configuration software to the device.
2. In the RFU6xx project tree open: Service > System Status

10.4 SICK service

If an error cannot be rectified, the device may be defective.

The device cannot be repaired by the customer. Interrupting or modifying the device will invalidate any warranty claims against SICK AG.

Fast replacement of a device by the customer is, however, possible.

▶ If a fault cannot be rectified, contact the SICK Service department. To find your agency, see the final page of this document.

> **NOTE**
> Before calling, make a note of all type label data such as type designation and serial number to ensure faster assistance.

10.5 Repairs

Repair work on the device may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the device by the customer will invalidate any warranty claims against SICK AG.

10.6 Returns

▶ Only send in devices after consulting with SICK Service.
▶ The device must be sent in the original packaging or an equivalent padded packaging.

> **NOTE**
> **Optional memory card**
>
> - Check whether there is a memory card in the card slot of the device. If yes, remove the memory card from the faulty device in **de-energized state**.
> - Do not send in the memory card!

> **(i) NOTE**
> To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:
>
> - Details of the contact person
> - Description of the application
> - Description of the fault that occurred
> - If available: configuration data (sdv file)

10.7 Replacing the device

10.7.1 Reusing the current configuration data

The configuration data of the device is combined as a parameter set. The replacement device saves the parameter set to the permanent parameter memory.

Prerequisites:
- The replacement device is a device of the same type.
- Device to be replaced: The current configuration data can be accessed from a storage medium outside the device memory.

The available options depend on the backup plan chosen by the customer back at the time of installation, and the configuration of the device now needing to be replaced.

The configuration data of the device to be replaced can be transferred to a replacement device in four ways.

No.	Method	Prerequisite	Note
1	Transfer of the configuration data using the optional memory card removed from the device to be replaced	The device automatically transferred the configuration data to the memory card in the device. This occurred at the last permanent save using the "permanent" option.	It is not necessary to connect a computer with the SOPAS ET configuration software for transfer to the replacement device.
2	Transfer of the configuration data using the optional CMC600 parameter cloning module in the optional connection module	The device to be replaced was continuously operated in conjunction with a CMC600 parameter cloning module in the connection module.	If a memory card and a parameter cloning module are used, the configuration data in the parameter cloning module have a higher priority. It is not necessary to connect a computer with the SOPAS ET configuration software for transfer to the replacement device.
3	Transfer of the configuration data using the parameter memory in the optional CDF600 bus connection module	The device to be replaced was continuously operated in proxy mode on the CDF bus connection module. If both a memory card and a CDF600 bus connection module are present, the configuration data in the CDF bus connection module have a higher priority.	It is not necessary to connect a computer with the SOPAS ET configuration software for transfer to the replacement device.
4	Transfer of the configuration data by means of a download from the computer	The configuration data of the device to be replaced were saved on the computer. This took place on completion of configuration of the device using the SOPAS ET configuration software.	

The first three methods are performed semi-automatically by the device depending on the setup. The fourth method is performed manually.

> **NOTE**
> For further information see "Information on initial commissioning", page 60

10.7.2 Removing the device to be replaced

> **!** **NOTICE**
> **Risk of damage to the memory card**
>
> ► To avoid damaging the microSD memory card, make sure the device is **de-energized** when you insert or remove the card. For this purpose, disconnect the device from the supply voltage.

1. Mark the position and alignment of the device on the bracket or surroundings.
2. Disconnect and remove all connecting cables from the device.
3. Detach device. Remove from the bracket.
4. Saved configuration data: If an optional memory card is installed in the device, remove the memory card with the saved parameter set. The memory card is located behind the side cover, see "Device view", page 15.

10.7.3 Putting the replacement device into operation

1. Backed-up configuration data: take the optional memory card from the device being replaced and install it in the replacement device of the same type.
2. Mount and align the replacement device (see "Mounting", page 24). When doing so, note the previously applied markings on the bracket or surroundings.
3. Reconnect the connecting cables to the replacement device (see "Electrical installation", page 31).
4. Switch on the supply voltage for the replacement device.
   The device starts up with the default setting. The device then searches for external storage media with a valid parameter set. If the device detects storage media with a valid parameter set, the device does the following:
   o Memory card in the device and CM600 parameter cloning module in the CDB/CDM connection module: the replacement device loads the parameter set from the CM600 parameter cloning module.
   o Memory card in the device and CDF bus connection module: the replacement device loads the parameter set from the CDF bus connection module.
   The replacement device loads the parameter set into its permanent memory. The device now operates using the configuration data.
5. If the replacement device does not detect any external storage medium, the device starts with its last permanently stored parameter set. In the case of devices that have not been used before, this corresponds to the factory default setting.
   ► Establish a connection with the replacement device using the SOPAS ET configuration software.
   ► Transfer the configuration data of the device to be replaced, which was previously saved to the computer, by downloading it to the replacement device and permanently storing it there.

11 Decommissioning

11.1 Disposal

If a device can no longer be used, dispose of it in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. Do not dispose of the product along with household waste.

> **!** **NOTICE**
> **Danger to the environment due to improper disposal of the device.**
> Disposing of devices improperly may cause damage to the environment.
> Therefore, observe the following information:
>
> - Always observe the national regulations on environmental protection.
> - Separate the recyclable materials by type and place them in recycling containers.

12 Technical data

> **NOTE**
>
> The relevant online product page for your product, including technical data, dimensional drawing, and connection diagrams, can be downloaded, saved, and printed from the Internet.
>
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
>
> {P/N} corresponds to the part number of the product, see type label.
>
> {S/N} corresponds to the serial number of the product, see type label (if indicated).
>
> Please note: This documentation may contain further technical data.

12.1 Features

Table 21: Technical data for RFU650: Features

	RFU650-101xx
Version (working range)	Long Range
Product category	RFID read/write device (UHF) with integrated antenna
Radio equipment approval (regional assignment)	Depending on type (country variants), see Technical Information RFU65x Regulatory Compliance Information [1]
Frequency band	
Transmitting power	
RFID standard (air interface)	ISO/IEC 18000-63, EPCglobal UHF Class 1 Generation 2 Labeling in type code: RFU6x**0**-xxxxx
Modulation	PR-ASK, DSB-ASK
Read range	≤ 10 m [2]
Antenna	Integrated antenna: • Transmitting power: Adjustable • Polarization: circular (RHCP [3]) • Axis behavior: Typically 2 dB • Opening angle: vertical 80°, horizontal 55° • Front-to-back ratio: Typically > 15 dB
Service functions	Automatic saving of parameter data (parameter cloning) outside the device memory: • Using insertable microSD memory card [4] in the device • Externally via the optional CMC600 parameter cloning module [4] in the CDB650-204[4] or CDM420 [4] connection module • Externally via the optional CDF600 fieldbus module [4]
Clock	Via network time protocol (NTP), no internal clock
Conformities	Certificates are type-dependent (country variants), see: • Technical Information RFU65x Regulatory Compliance Information [1] UL: RFU650-10101 (USA and Canada) [5]

[1] A printed copy of the document is enclosed with the device.
[2] The read range depends on the transponder used and the ambient conditions.
[3] RHCP (Right-Hand Circular Polarization) = right-hand circular polarized.
[4] Optional accessories.
[5] UL-certified if the type label contains the UL logo and the UL conditions are met during device operation. For further information, see "UL conformity", page 81.

> **NOTE**
>
> You will find the Technical Information RFU65x Regulatory Compliance Information on the product page.
>
> The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**
>
> {P/N} corresponds to the part number of the product, see type label.
>
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

12.2 Interfaces

Table 22: Technical data for RFU650: Interfaces

	RFU650-101xx
Ethernet	• Protocols: TCP/IP, OPC UA (Companion Spec V1.0, from firmware V2.20) • Function: Host (data output of the read result) • Function: AUX for service [1] • Data transmission rate 10/100 Mbit/s • Services: DHCP, NTP, HTTP/HTTPS
PROFINET	• Protocol: PROFINET • Function: host (data output of read result), PROFINET Single Port [2] • Data transmission rate 10/100 Mbit/s • PROFINET dual port via an external CDF600-22xx [3] fieldbus module
EtherNet/IP™	• Protocol: EtherNet/IP™ • Function: Host (data output of the read result) • Data transmission rate 10/100 Mbit/s
EtherCAT®	• Protocol: EtherCAT® • Function: Host (data output of the read result) [2] • Via external CDF600-0300 [3] fieldbus module (gateway mode) to EtherCAT®
PROFIBUS	• Protocol: PROFIBUS • Function: Host (data output of the read result) [2] • Via external CDF600-21xx fieldbus module [3] to PROFIBUS (RS-485)
Serial	**Host:** • Protocol: RS-232, RS-422 • Function: Host (data output of the read result) • Data transmission rate 0.3 kBd ... 115.2 kBd • Cable: RS-232 (2-wire and ground) • Cable: RS-422 (4-wire and ground) **AUX:** • Protocol: RS-232 • Function: AUX for service [1] • Data transmission rate: 57.6 kBd • Cable: RS-232 (2-wire and ground)

CAN	• Protocol:
	   ○ CSN (SICK CAN sensor network)
	   ○ CANopen®
	 • Function: Host (data output of the read result)
	 • Data transmission rate: 20 kBit/s ... 1 MBit/s
	 • Bus length: depends on data transmission rate and cable cross-section [4]

USB 2.0 [5]	• Function: AUX for service [1]

	RFU650-101xx
Digital inputs	- Quantity: 2 - Design: Physical, switching - Optional additionally: 2 inputs, version: logic, switching. Implemented using CMC600 module [3] in the CDB [3] or CDM connection module [3] V_{in} [6] = max. 30 V, I_{in} [7] = max. 5 mA - Opto-decoupled, reverse polarity protected, adjustable debounce time
Digital outputs	- Quantity: 2 - Design: Physical, switching - Optional additionally: 2 outputs, version: logic, switching. Implemented using CMC600 module [3] in the CDB [3] or CDM connection module [3] V_{out} [8] = V_S [9] – 1.5 V, I_{out} [10] ≤ 100 mA (typical) - Short-circuit protected, temperature protected, not electrically isolated from the supply voltage
Optical displays	7 RGB LEDs (status display) at top of front 1 RGB LED (process feedback) at center of front. Display function can be set with pre-defined color assignment [11]
Acoustic indicator	- Beeper (buzzer), can be deactivated - Function for event signaling and volume adjustable [11]
Control elements	2 pushbuttons - Function: Selecting and starting or stopping functions
Configuration	SOPAS ET configuration software, CoLa commands (telegrams), web server, fieldbus controller (PLC) with additional support by SICK function blocks
Programming	Application-specific programming with the SICK AppStudio [12] development environment. You can find further information on the Internet at: www.sick.com/SICK_AppStudio

[1] Service: For example configuration, diagnostics, transponder access or prepared display of the read result.
[2] Function blocks for PLC types from different manufacturers are available on the product page under www.sick.com/RFU65x.
[3] Optional accessories.
[4] Typically: 250 m at 250 kBit/s and wire cross-section ≥ 0.34 mm^2.
[5] The USB interface is only for temporary use as a service interface.
[6] Input voltage.
[7] Input current.
[8] Output voltage.
[9] Supply voltage.
[10] Output current.
[11] For example using the SOPAS ET configuration software.
[12] This functionality can be unlocked with the SDK6U SD card. Available online at: www.sick.com.

ℹ️ **NOTE**
You will find SICK function blocks for various types of PLC from different manufacturers on the product page.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

12.3 Mechanics and electronics

Table 23: Technical data for RFU650-101xx: Mechanics and electrics

	RFU650-101xx
Connection type	Ethernet, serial • Power/serial data/CAN/I/O: 1 male connector, M12, 17-pin, A-coded • Ethernet: 1 female connector, M12, 4-pin, D-coded • USB : 1 female connector, USB, 5-pin, type Micro-B • Card slot for the MicroSD memory card
Supply voltage V_S	• ES1 according to EN 62368-1, NEC protection class 2 (UL1310) • 18 V … 30 V DC [2] [3] • 12 V … 30 V DC [4] optional
Power consumption	Operation: • < 20 W typical [5] • Maximum 26 W [6] Standby: Typically 6 W
Housing	Aluminum die cast, polycarbonate
Housing color	Blue, black, silver
Side cover	• Aluminum, cover can be removed for temporary access to the USB interface and card slot • Recommended tightening torque for the cover screws: 40 Ncm ± 5 Ncm
Protective elements	For unused electrical connections Tightening torque: Hand tightened
MTBF	25 years [7]
Enclosure rating	IP67 (EN 60529:1991-10/A2:2000-02)
Protection class	III (EN 61140:2006-08)
Safety	EN 62368-1:2014-08
Weight	Approx. 4.3 kg
Dimensions (L x W x H)	400 mm x 252 mm x 70 mm [8]

[1] Behind side cover.
[2] When connected to the optional SICK CDB650-204 or CDM420-0006 connection module. Using a SICK cable
[3] When operated without a connection module using a SICK cable. 2 A fuse protection at the start of the feeding supply circuit.
[4] When operated without a connection module using a SICK supply cable part no. 6048319 (2 x 2.5 mm², 10 m). 2.5 A fuse protection at the start of the feeding supply circuit.
[5] At full transmitting power and unloaded digital outputs
[6] At full transmitting power and with a typical loading of the 2 digital outputs of 100 mA each and with a 30 V DC supply voltage.
[7] Continuous operation at an ambient operating temperature of +50 °C.
[8] see "Device view", page 15.

12.4 Ambient data

Table 24: Technical data of RFU650-101xx: Ambient data

	RFU650-101xx
Electromagnetic compatibility (EMC)	EN 301489-3
Vibration resistance	EN 60068-2-6:2008-02
Shock resistance	EN 60068-2-27:2009-05

	RFU650-101xx
Ambient temperature	• Operation: -25 °C(-30 °C [1]) ... +60 °C • Storage [2]: -30 °C ... +70 °C
Permissible relative humidity	0% ... 90%, non-condensing

[1] For firmware version V2.02 or higher.
[2] Storage conditions see "Storage", page 23.

12.5 Working range diagram

RFU650: see "Read range", page 15.

12.6 Dimensional drawing

RFU650-101xx: Dimensions see "Device view", page 15.

13 Accessories

> **i**
>
> **NOTE**
>
> On the product page you will find accessories and, if applicable, related installation information for your product.
>
> The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}
>
> {P/N} corresponds to the part number of the product, see type label.
>
> {S/N} corresponds to the serial number of the product, see type label (if indicated).

14 Annex

14.1 Declarations of conformity and certificates

You can download declarations of conformity and certificates via the product page.

The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

14.2 UL conformity

Several devices (country variants for USA) in the RFU6xx product family are certified to UL 61010-1; the UL file number is E336916.

The certification is only valid for specific type descriptions on the type label of the respective device, see "Type label", page 13.

Device type RFU650: see "Features", page 75 in the technical data.

UL-certified devices require a supply voltage according to ES1, EN 62368-1, NEC protection class 2 (UL1310).

The IP67 enclosure rating of the devices is not checked by UL.

14.3 Dimensional drawings (electronic)

NOTE
You will find dimensional drawings in various electronic formats on the product page.

The call is made via the **SICK Product ID: pid.sick.com**/{P/N}/{S/N}

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

14.4 Signal assignment of cables with open cable end at one end

14.4.1 RFU650: "Power/SerialData/CAN/I/O" connection to customer-specific connection equipment (voltage supply or control cabinet)

14.4.1.1 "Power/SerialData/CAN/I/O" connection to customer-specific connection equipment or control cabinet

Adapter cable, straight female connector, open

Part no. 2075220 (5 m), shielded, suitable for 2 A, suitable for drag chain, deep-freeze compatible

For RFU630, RFU650

Permitted currents for ambient temperature +40 °C:

- Contact 1 (blue) and contact 2 (brown): 2 A
- All other contacts: 1.5 A

Ambient temperature range:

For mobile installation: –25 °C to +40 °C, for fixed installation:: –35 °C to +40 °C
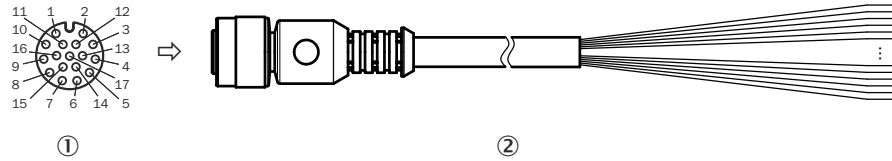

Figure 31: Adapter cable, part no. 2075220

① Female connector, M12, 17-pin, A-coded (front view)
② Figure may differ.

Table 25: Signal assignment of adapter cable with open end

PIN	Signal	Function	Wire color
1	GND	Ground	Brown
2	V_S	Supply voltage	Blue
3	CAN L	CAN bus (IN/OUT)	White
4	CAN H	CAN bus (IN/OUT)	Green
5	–	–	Pink
6	TxD (RS-232), host	Host interface (sender)	Yellow
7	–	–	Black
8	–	–	Gray
9	SensGND	Ground for digital inputs	Red
10	Sensor 1	Digital input 1	Violet
11	–	–	Gray-pink
12	RxD (RS-232), host	Host interface (receiver)	Red-blue
13	Result 1	Digital output 1	White-green
14	Result 2	Digital output 2	Brown-green
15	Sensor 2	Digital input 2	White-yellow
16	Result 3	Digital input 3	Yellow-brown
17	N. c.	–	White-gray

14.4.2 "POWER" connection to customer-specific connection equipment (voltage supply) or control cabinet

Adapter cable

Part no. 6048319 (10 m), 3-wire, unshielded

For RFU630, RFU650

Ambient temperature range:
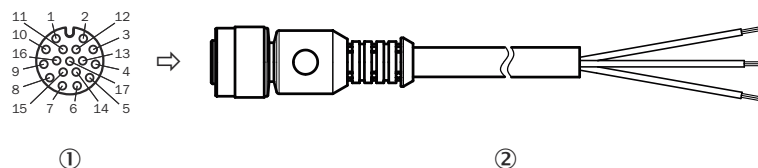
For fixed installation: –25 °C to +80 °C

Figure 32: Adapter cable, part no. 6048319 (10 m)

① Female connector, M12, 17-pin, A-coded (front view)
② Illustration may differ

Table 26: Signal assignment of adapter cable with open end

Pin	Signal	Function	Wire color
1	GND	Ground	Brown
2	V_S	Supply voltage	Blue
–	–	Not applicable [1]	Black

[1]   Wire not connected in the female connector.

14.4.3   CDB650-204 or CDM420-0006 to CAN network connection module

Adapter cable

Part no. 6021166 (5 m), unshielded

Ambient temperature range:

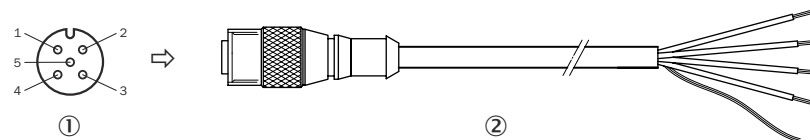For fixed installation: –40 °C to +70 °C, for mobile installation: –20 °C to +70 °C

Figure 33: Adapter cable, part no. 6021166 (5 m) for connecting the connection module to the CAN network

①   Female connector, M12, 5-pin, A-coded (front view)

②   Illustration may differ

②   Illustration may differ

Table 27: Pin, signal and wire color assignments for the adapter cable with open end

Pin	Signal	Function	Wire color
1	–	Shield	–
2	V_S	Supply voltage	Red
3	GND	Ground	Black
4	CAN H	CAN bus (IN/OUT)	White
5	CAN L	CAN bus (IN/OUT)	Blue

14.4.4   "Power/SerialData/CAN/I/O" connection to customer-specific connection equipment or control cabinet

Adapter cable, straight female connector, open end

Part no. 2070425 (3 m), part no. 2070426 (5 m), part no. 2070427 (10 m), shielded, suitable for 2 A, suitable for drag chain

For RFU630, RFU650

Ambient temperature range:

For mobile installation: –25 °C to +80 °C, for fixed installation: –40 °C to +80 °C
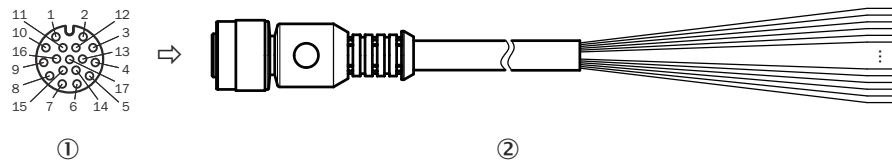
Figure 34: Adapter cable, e.g., part no. 2070425 (3 m)

① Female connector, M12, 17-pin, A-coded (front view)

② Figure may differ.

Table 28: Signal assignment of adapter cable with open end

Pin	Signal	Function	Wire color
1	GND	Ground	Blue
2	V_S	Supply voltage	Brown
3	CAN L	CAN bus (IN/OUT)	Green
4	CAN H	CAN bus (IN/OUT)	White
5	TD+ (RS-422), Host	Host interface (sender+)	Pink
6	TD– (RS-422), Host TxD (RS-232), host	Host interface (sender-)	Yellow
7	TxD (RS-232), Aux	AUX interface (sender)	Black
8	RxD (RS-232), Aux	AUX interface (receiver)	Gray
9	SensGND	Ground digital inputs	White-black
10	Sensor 1	Digital input 1	Violet
11	RD+ (RS-422) Host	Host interface (receiver+)	Gray-pink
12	RD– (RS-422), host RxD (RS-232), host	Host interface (receiver–)	Red-blue
13	Result 1	Digital output 1	White-green
14	Result 2	Digital output 2	Brown-green
15	Sensor 2	Digital input 2	White-yellow
16	N. c.	Not connected	Yellow-brown
17	N. c.	Not connected	White-gray

14.4.5 Host interface RS-232 via connection module CDB/CDM to host (computer)

Device	Connection module
RFU650	CDB650-204, CDM420-0006, -0007

Adapter cable, straight female connector, open end

Part no. 2020319 (3 m), unshielded

Ambient temperature range:

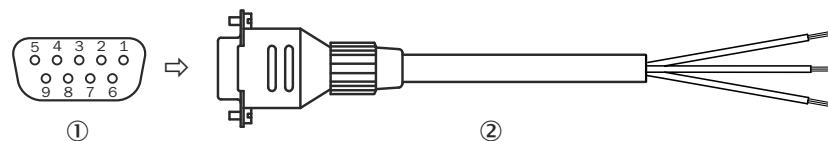For fixed installation: –25 °C to +40 °C

Figure 35: Adapter cable, part no. 2020319

① Female connector, D-Sub, 9-pin (front view)

② Figure may differ.

② Illustration may differ

Table 29: Signal assignment of adapter cable with open end

Pin	Signal at computer	Function	Wire color
1	–	–	–
2	RxD (RS-232), host	Host interface (receiver)	Brown [1]
3	TxD (RS-232), host	Host interface (sender)	Blue [2]
4	–	–	–
5	GND	Ground	Black
6 … 9	–	–	–

[1] Connect to the "TxD Host" terminal in the CDB/CDM connection module
[2] Connect to the "RxD Host" terminal in the CDB/CDM connection module

14.5 Connection diagrams of connection module CDB650-204

14.5.1 Connection of the device to CDB650-204
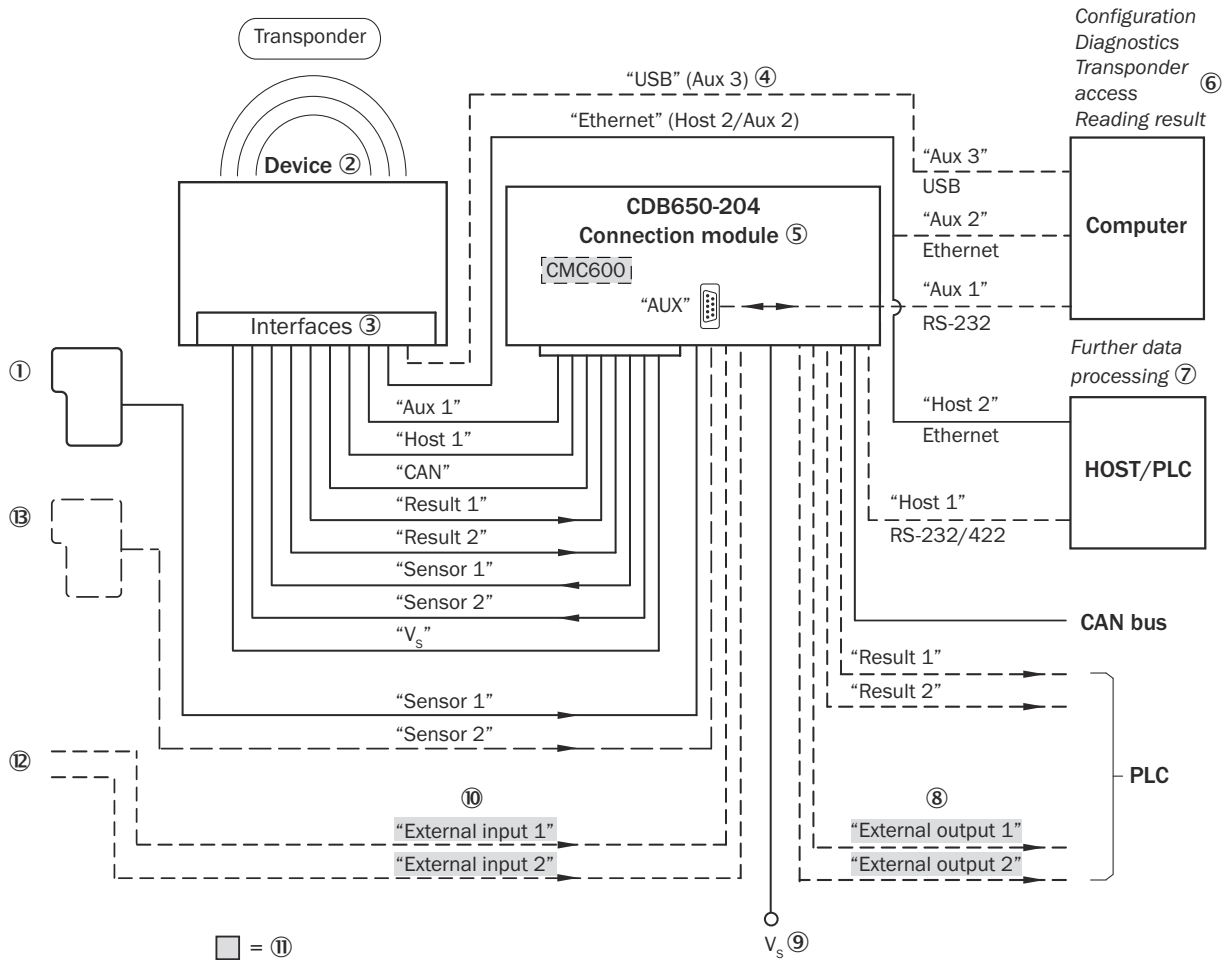
Device = RFU650-101xx

Figure 36: Connection of the device to peripherals via CDB650-204 (overview)

① External trigger sensor, e.g. for read cycle generation
② Device
③ Interfaces

④　　USB interface, for temporary use as a servicing interface only

⑤　　Connection module

⑥　　Configuration, diagnostics, transponder access or display of read result

⑦　　Data further processing

⑧　　External digital outputs

⑨　　Supply voltage V_S

⑩　　External digital inputs

⑪　　The optional CMC600 is required in the connection module in order to use the additional external digital inputs and outputs of the device (highlighted in gray).

⑫　　Other functions

⑬　　Can also be used as an alternative stop reading cycle (e.g., photoelectric sensor) or travel increment (incremental encoder), depending on the application

14.5.2　　Wiring overview of the CDB650-204
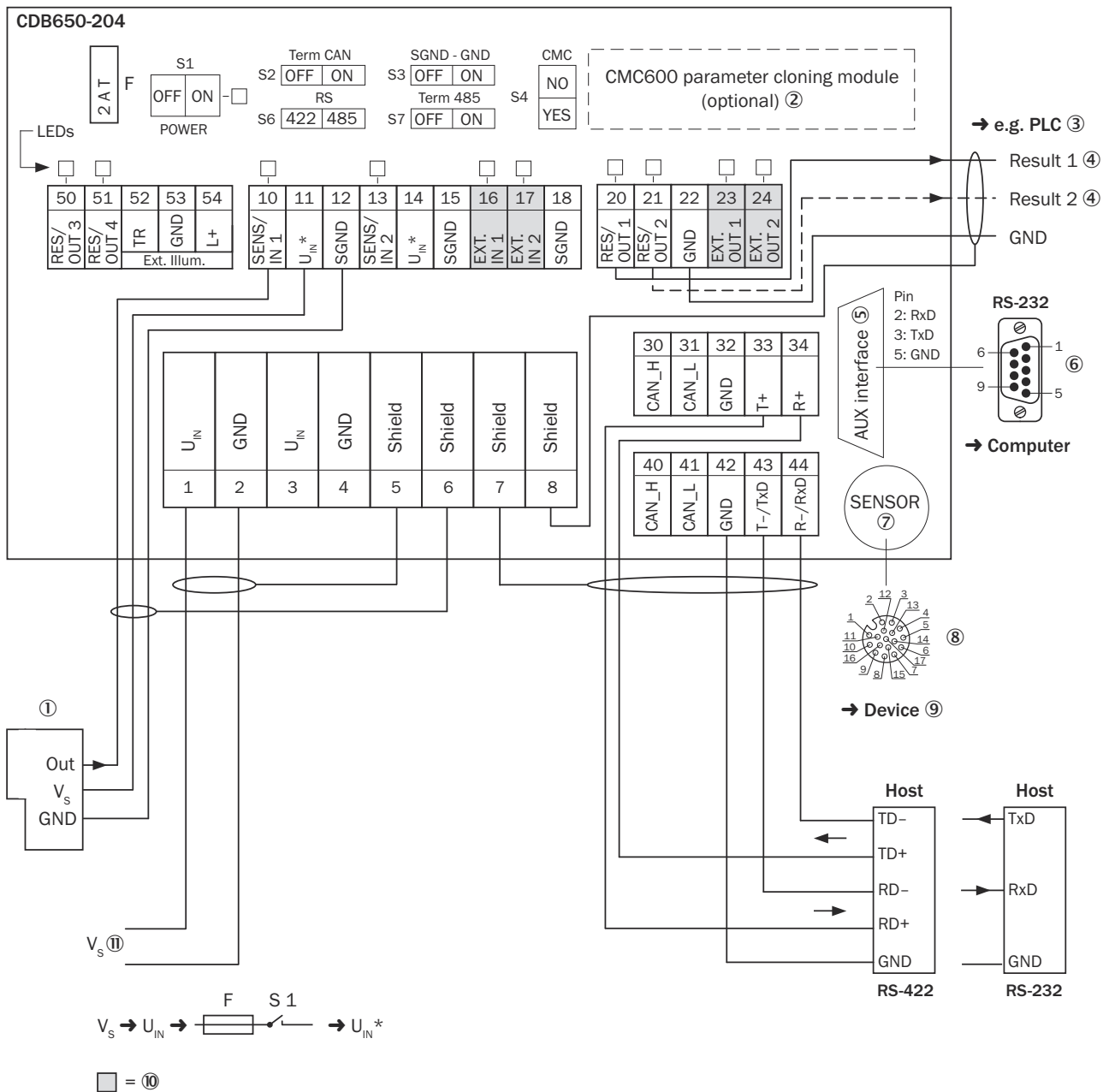
Device = RFU650-101xx, 1 digital input used

Figure 37: Overview: connection of device and peripherals to the CDB650-204 connection module.

① External trigger sensor, e.g. for read cycle generation
② CMC600 parameter cloning module (optional)
③ e.g. PLC (programmable logic controller)
④ Name of the digital output
⑤ Auxiliary interface "AUX"
⑥ Male connector, D-Sub, 9-pin
⑦ SENSOR = Device
⑧ Female connector, M12, 17-pin, A-coded
⑨ Device to be connected
⑩ The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device (highlighted in gray).
⑪ Supply voltage V_S

14.5.3 Connecting supply voltage for the device in CDB650-204
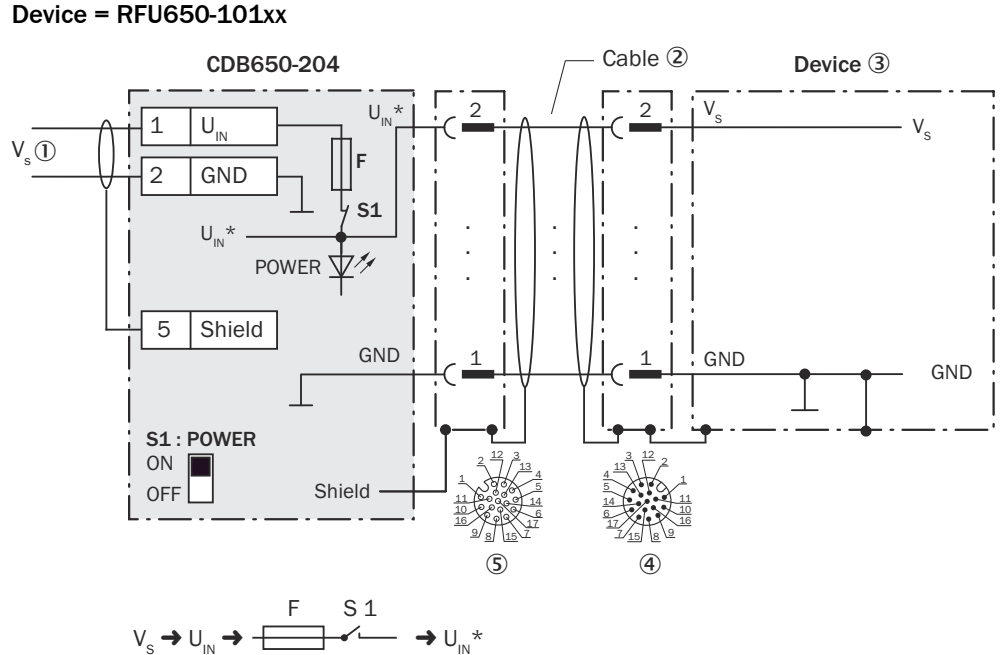
Device = RFU650-101xx

Figure 38: Connecting supply voltage for the device in CDB650-204 connection module.

①   Supply voltage V_S

②   Connection cable 1:1 with male connector, M12, 17-pin, A-coded and female connector, M12, 17-pin, A-coded

③   Device

④   Device: male connector, M12, 17-pin, A-coded

⑤   Connection module: female connector, M12, 17-pin, A-coded

Function of switch S1

Table 30: Switch S1: Power

Switch setting	Function
ON	Supply voltage U_{IN} connected to CDB650-204 and device via fuse and switch S1 as a supply voltage $U_{IN}*$ Supply voltage $U_{IN}*$ can be additionally tapped at terminals 11 and 14.
OFF	CDB650-204 and device disconnected from supply voltage Recommended setting for all connection work

14.5.4 Wiring serial host interface RS-232 of the device in CDB650-204
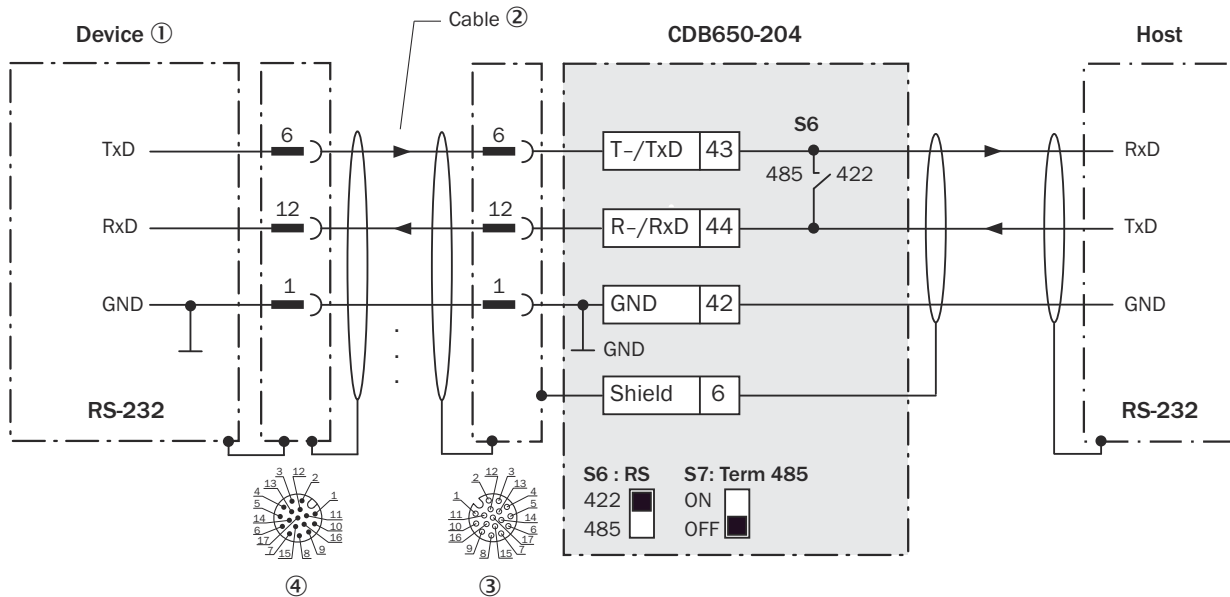
Device = RFU650-101xx

Figure 39: Wiring data interface RS-232 of the device in connection module CDB650-204.

①   Device
②   Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
③   Connection module: female connector, M12, 17-pin, A-coded
④   Device: male connector, M12, 17-pin, A-coded

> **NOTE**
> Activate the RS-232 data interface in the device with a configuration tool, e.g., the configuration software SOPAS ET.

14.5.5   Wiring serial host interface RS-422 of the device in CDB650-204
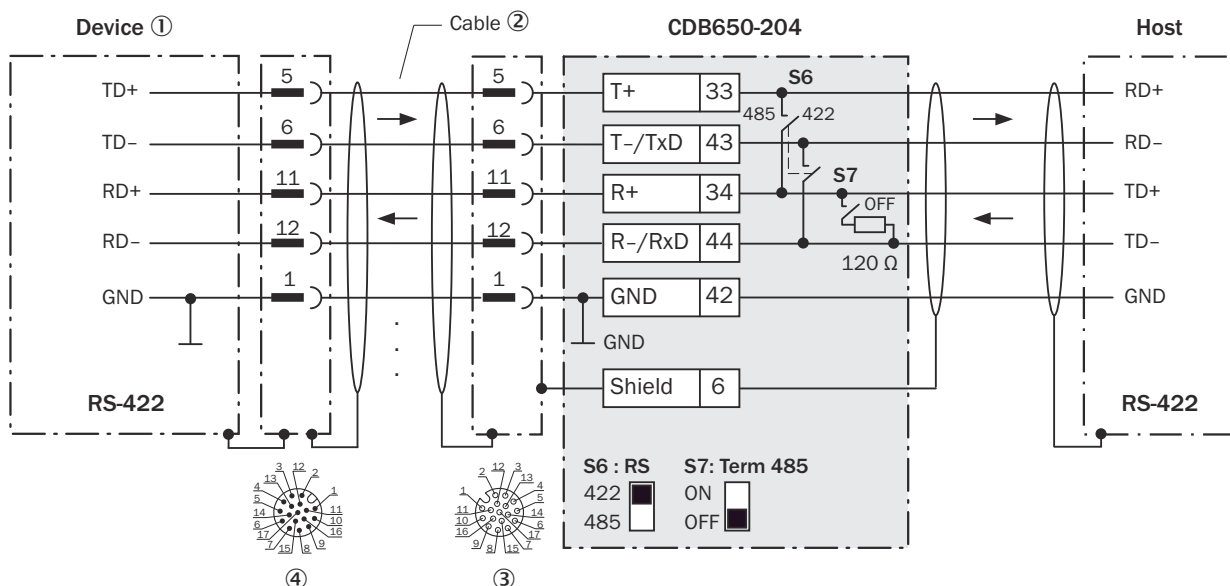
Device = RFU650-101xx

Figure 40: Wiring data interface RS-422 of the device in connection module CDB650-204.

①   Device
②   Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
③   Connection module: female connector, M12, 17-pin, A-coded
④   Device: male connector, M12, 17-pin, A-coded

Function of switch S7

Table 31: Switch S7: Term 485

Switch setting	Function
ON	Terminates the RS-422 receiver in the device to improve the noise ratio on the line
OFF	No termination

NOTE

User of the RS-422 data interface:

- RS-422 operation only 4-wire with ground!
- The relevant interface drivers for the device comply with the standard in accordance with RS-422.
- The connection shown above is configured for operation of the host with permanently activated drivers (often described as "RS-422 operation").
- Activate the RS-422 data interface ("Point-to-Point" option) in the device with a configuration tool, e.g. configuration software SOPAS ET.

14.5.6 Wiring the CAN interface of the device in the CDB650-204
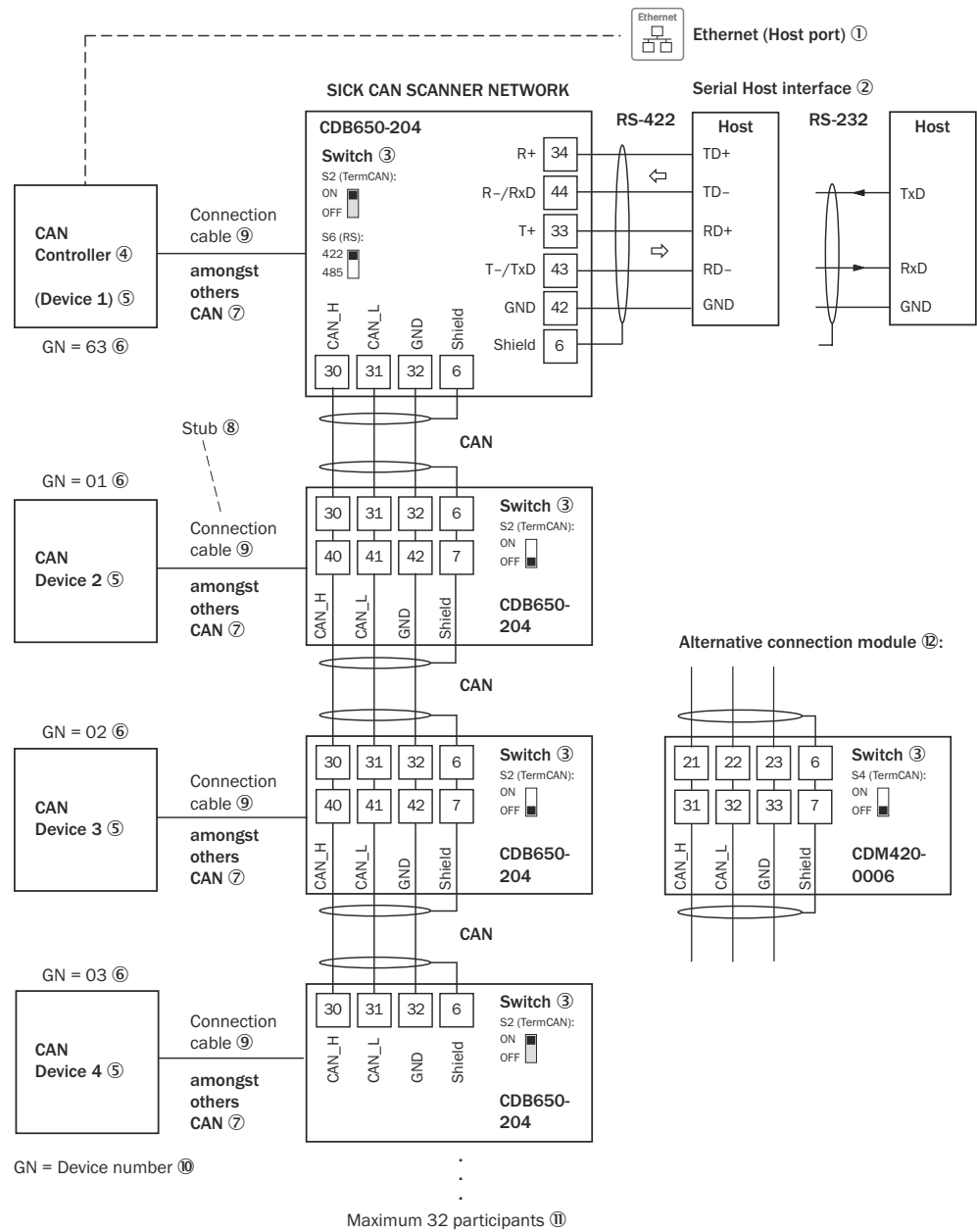
Device = RFU650-101xx

Figure 41: Wire the CAN interface of the device in the CDB650-204 connection module. Connection and looping through of the supply voltage and connection of a trigger sensor for read cycle generation at the CAN controller, for example, are disregarded here.

①   Ethernet (host port): RFU650-101xx
②   Serial host interface
③   Switch
④   CAN controller
⑤   CAN device
⑥   Device number
⑦   CAN etc.
⑧   Branch line
⑨   RFU650-101xx: connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
⑩   Device number (GN)
⑪   Maximum 32 users

⑫   Example of alternative connection module

Alternative connection module for RFU650: CDM420-0006

An adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin is required to connect the RFU65x-101xx.

ℹ️ **NOTE**

Activate the CAN data interface in the device with a configuration tool, e.g., the configuration software SOPAS ET.

Make further settings in the device corresponding to the function of the device in the system configuration.

14.5.7   Wiring digital inputs of the device in the CDB650-204

Device = RFU650-101xx

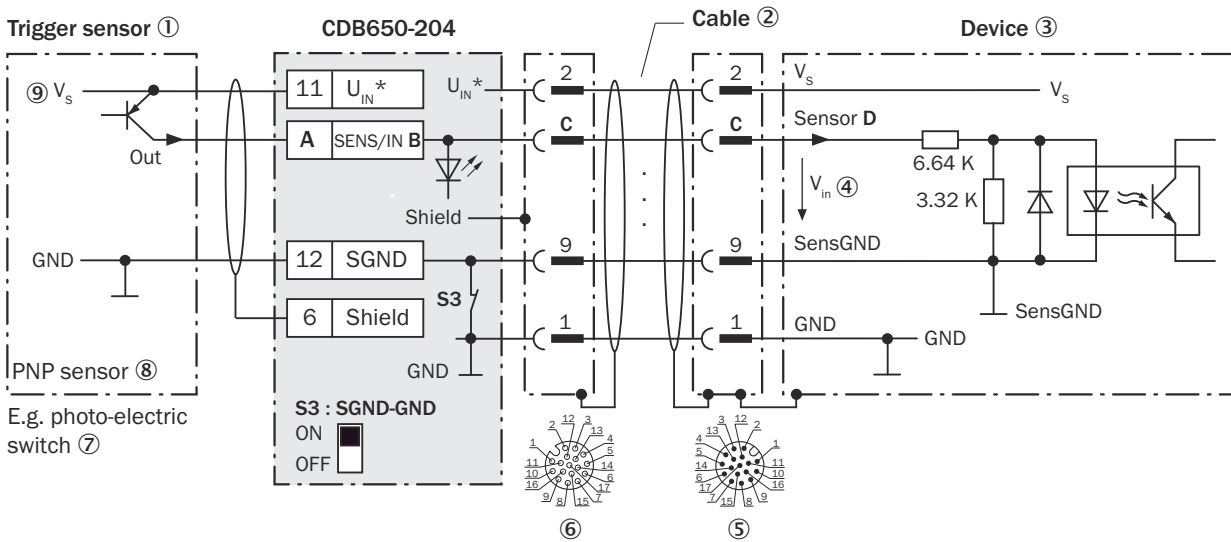*Figure 42: Trigger sensor supplied with power by connection module CDB650-204*

①   Trigger sensor, e.g. for read cycle generation
②   Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
③   Device
④   Input voltage V_{in}
⑤   Device: male connector, M12, 17-pin, A-coded
⑥   Connection module: female connector, M12, 17-pin, A-coded
⑦   E.g. photoelectric sensor
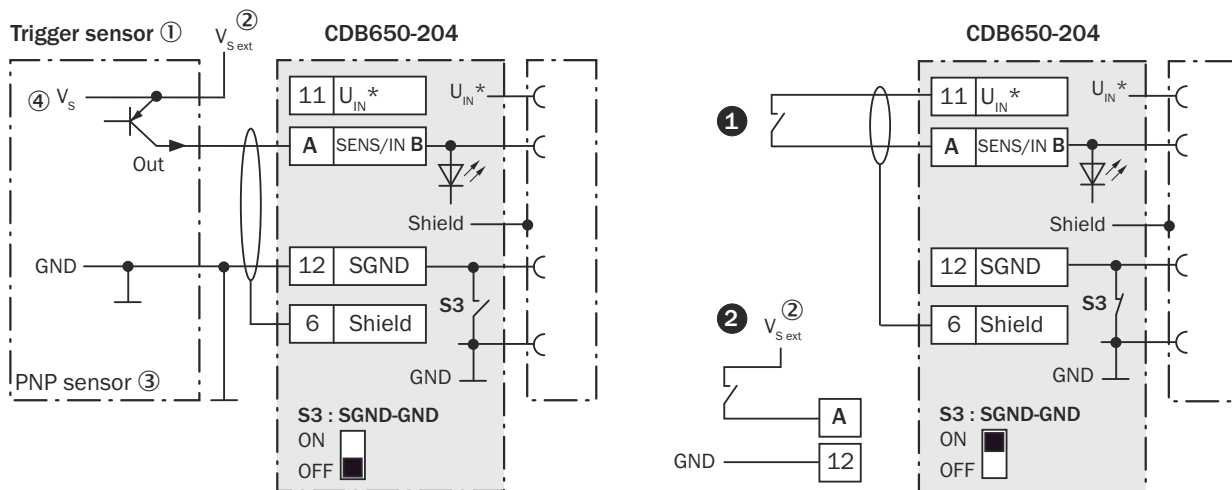⑧   PNP sensor
⑨   Supply voltage V_S

Figure 43: Left: Trigger sensor connected potential-free and supplied with power externally. Right: Alternatively switch, ❶ supplied with power by connection module CDB650-204 or ❷ connected potential-free and supplied with power externally. Now select switch setting S3 as shown in the left figure.

①   Trigger sensor, e.g., for read cycle generation
②   External supply voltage $V_{S\,ext}$
③   PNP sensor
④   Supply voltage V_S

Table 32: Assignment of placeholders to the digital inputs

CDB650-204			Device
Terminal A	Signal B	Pin C	Sensor D
10	SENS/IN 1	10	1
13	SENS/IN 2	15	2

Function of switch S3

Table 33: Switch S3: SGND-GND

Switch setting	Function
ON	GND of the trigger sensor is connected with GND of CDB650-204 and GND of the device
OFF	Trigger sensor is connected volt-free at CDB650-204 and the device. Common, isolated reference potential of all digital inputs is SGND.

Characteristic data of the digital inputs

Table 34: Characteristic data of the digital inputs "Sensor 1" and "Sensor 2"

Type	Switching
Switching behavior	Power to the input starts the assigned function, e.g. start read cycle. Default setting in the device: logic not inverted (active high), debounce time 10 ms
Properties	• Opto-decoupled, reverse polarity protected • Can be wired with PNP output of a trigger sensor
Electrical values	Low: V_{in} [1] ≤ 2 V; I_{in} [2] ≤ 0.3 mA High: 6 V ≤ V_{in} ≤ 30 V; 0.7 mA ≤ I_{in} ≤ 5 mA

[1]   Input voltage.
[2]   Input current.

> **NOTE**
> Assign the functions for the digital inputs in the device using a configuration tool, e.g., the configuration software SOPAS ET.

14.5.8 Wiring the external digital inputs of the device in the CDB650-204
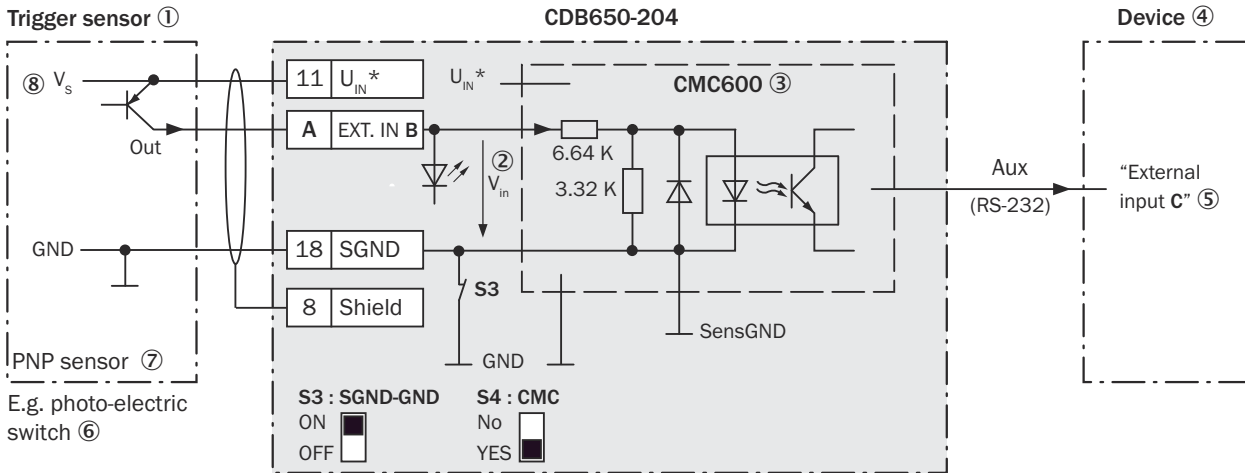
Device = RFU650-101xx

Figure 44: Trigger sensor supplied with power by connection module CDB650-204

① Trigger sensor, e.g., for read cycle generation
② Input voltage V_{in}
③ The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and digital outputs of the device.
④ Device
⑤ Logical "External input" in the device
⑥ E.g. photoelectric sensor
⑦ PNP sensor
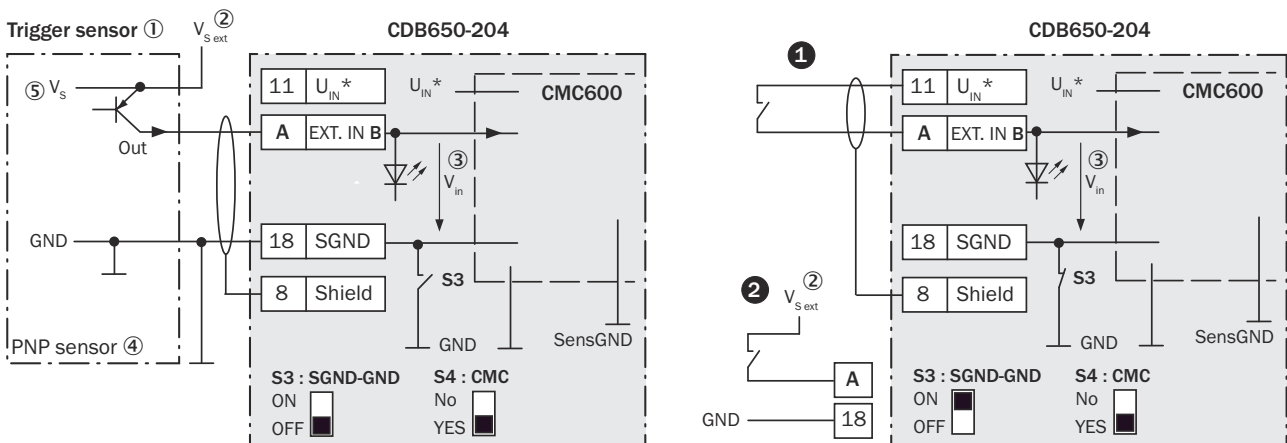⑧ Supply voltage V_S

Figure 45: Left: Trigger sensor connected potential-free and supplied with power externally. Right: Alternatively switch, ❶ supplied with power by connection module CDB650-204 or ❷ connected potential-free and supplied with power externally. Switch setting S3 then as in left figure.

① Trigger sensor, e.g. for read cycle generation

②   External supply voltage $V_{S\,ext}$
③   Input voltage V_{in}
④   PNP sensor
⑤   Supply voltage V_S

Table 35: Assignment of placeholders to the external digital inputs

CDB650-204 (physical inputs)		Device (logical inputs)
Terminal A	**Signal B**	**External input C**
16	EXT. IN 1	1
17	EXT. IN 2	2

Function of switch S3

Table 36: Switch S3: SGND - GND

Switch setting	Function
ON	GND of the trigger sensor connected with GND of CDB650-204 and CMC600
OFF	Trigger sensor connected volt-free at CDB650-204 and CMC600 Common, isolated reference potential of all digital inputs is SGND.

Functional principle of the external digital inputs

The optional CMC600 parameter cloning module in combination with the CDB or CDM connection module offers two additional physical digital inputs for the device. The inputs are available at the respective terminals of the connection module. To distinguish them from the physical digital inputs directly on the device, these addition inputs via the CMC600 are designated as "external inputs".

ⓘ **NOTE**
The transmission of the input signals on the CMC600 to the device may be delayed by up to 15 ms.

Characteristic data of the digital inputs

Table 37: Characteristic data of the digital inputs "External input 1" and "External input 2"

Type	Switching
Switching behavior	Power to the input starts the assigned function, e.g. start read cycle. Default setting in the device: logic not inverted (active high), debounce time 10 ms
Properties	• Opto-decoupled, reverse polarity protected • Can be wired with PNP output of a trigger sensor
Electrical values	Low: V_{in} [1] ≤ 2 V; I_{in} [2] ≤ 0.3 mA High: 6 V ≤ V_{in} ≤ 30 V; 0.7 mA ≤ I_{in} ≤ 5 mA

[1]   Input voltage.
[2]   Input current.

ⓘ **NOTE**
Assign the functions for the external digital inputs in the device using a configuration tool, e.g., the SOPAS ET configuration software.

14.5.9   Wiring digital outputs of the device in the CDB650-204
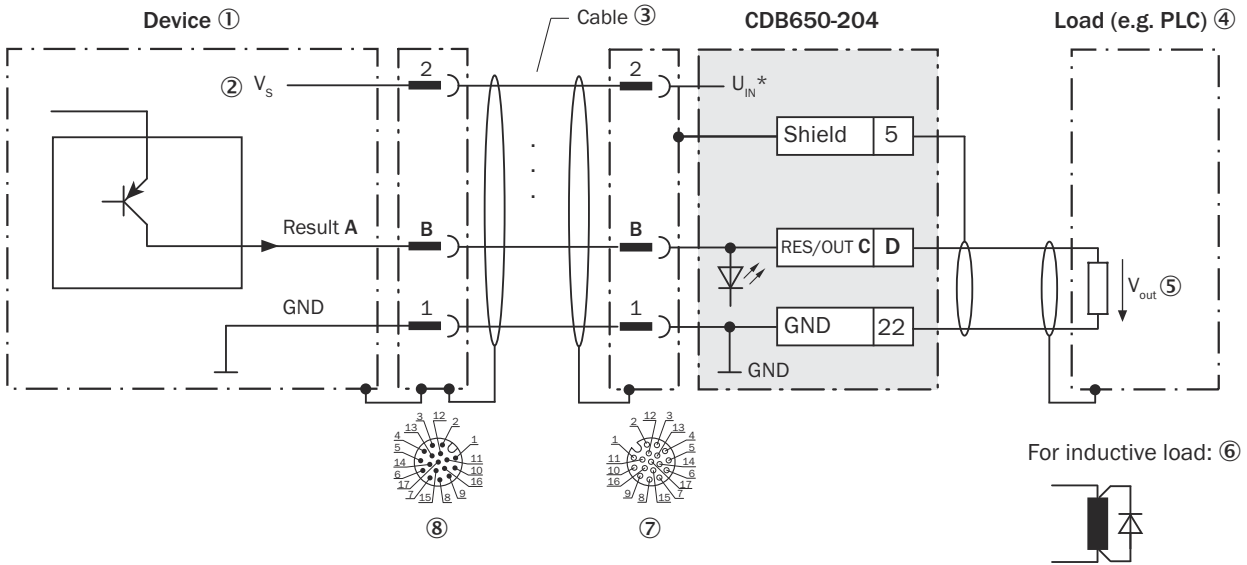
Device = RFU650-101xx

Figure 46: Wiring the "Result 1" and "Result 2" digital outputs of the device in connection module CDB650-204.

①   Device
②   Supply voltage V_S
③   Connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded
④   Load (e.g. PLC)
⑤   Output voltage V_{out}
⑥   With inductive load: see note
⑦   Connection module: female connector, M12, 17-pin, A-coded
⑧   Device: male connector, M12, 17-pin, A-coded

Inductive load

> **NOTE**
> Provide an arc-suppression switch at the digital output if inductive load is present.
>
> ►   Attach a freewheeling diode directly to the load for this purpose.

Table 38: Assignment of placeholders to the digital outputs

Device		CDB650-204	
Output A	Pin B	Signal C	Terminal D
Result 1	13	RES/OUT 1	20
Result 2	14	RES/OUT 2	21

Characteristic data of the digital outputs

Table 39: Characteristic data of the digital outputs "Result 1" and "Result 2"

Type	Switching
Switching behavior	PNP switching to supply voltage V_S Default settings in the device: no function, logic: not inverted (active high)
Properties	• Short-circuit protected and temperature protected • Not electrically isolated from the supply voltage V_S

Electrical values	$0\ V \leq V_{out}^{\ 1)} \leq V_S$
	$(V_S - 1.5\ V) \leq V_{out} \leq V_S$ at $I_{out}^{\ 2)} \leq 100$ mA

1) Output voltage.
2) Output current.

i **NOTE**
Assign the functions for the digital outputs in the device using a configuration tool, e.g., the configuration software SOPAS ET.

14.5.10 Wiring the external digital outputs of the device in the CDB650-204
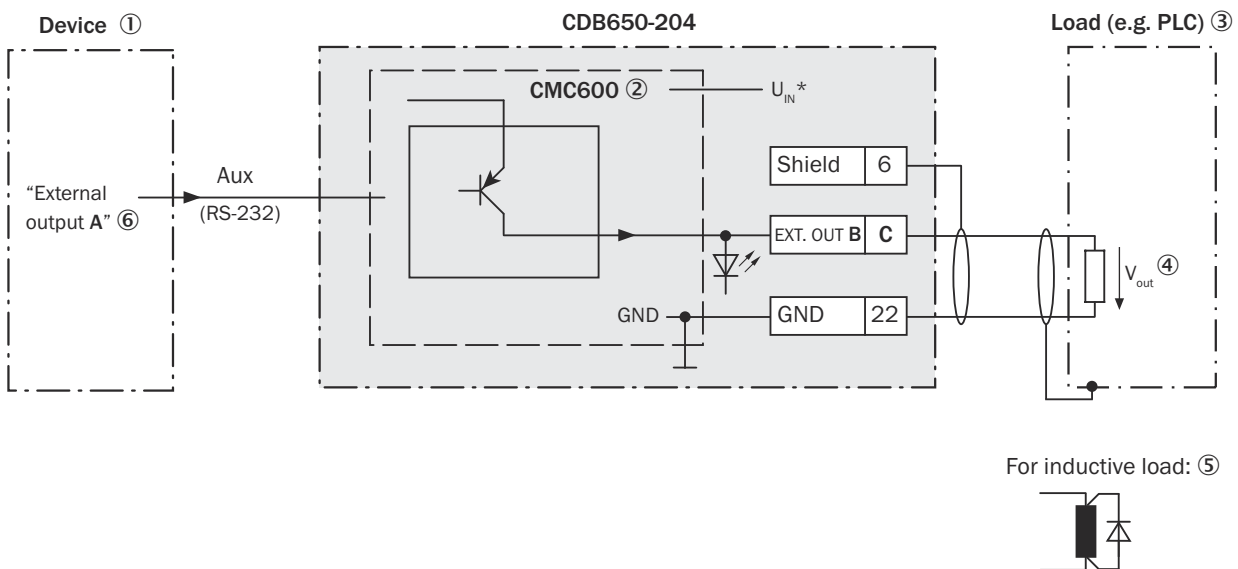
Device = RFU650-101xx

Figure 47: Wiring external "External output 1" and "External output 2" digital outputs of the device in the CDB650-204 connection module.

① Device
② The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device.
③ Load (e.g. PLC)
④ Output voltage V_{out}
⑤ With inductive load: see note
⑥ Logical "External output" in the device

Inductive load

i **NOTE**
Provide an arc-suppression switch at the digital output if inductive load is present.

▶ Attach a freewheeling diode directly to the load for this purpose.

Table 40: Assignment of placeholders to the digital outputs

Device (logical output)	CDB650-204 (physical output)	
External output A	**Signal B**	**Terminal C**
1	EXT. OUT 1	23

Device (logical output)	CDB650-204 (physical output)	
External output A	Signal B	Terminal C
2	EXT. OUT 2	24

Functional principle of the external digital outputs

The optional CMC600 parameter cloning module in combination with the CDB or CDM connection module offers two additional digital outputs for the device. The outputs are available at the respective terminals of the connection module. To distinguish them from the physical digital outputs directly on the device, these addition outputs via the CMC600 are designated as "external outputs".

i **NOTE**
The device transmits the statuses of its logical outputs to the CMC600 via its serial data interface. The CMC600 converts the statuses into switching signals on its physical digital outputs.

The digital outputs are not suitable for time-critical applications.

Characteristic data of the digital outputs

Table 41: Characteristic data of the digital outputs "External output 1" and "External output 2"

Type	Switching
Switching behavior	PNP switching to supply voltage V_S Default settings in the device: no function, logic: not inverted (active high)
Properties	• Short-circuit protected and temperature protected • Not electrically isolated from the supply voltage V_S
Electrical values	$0\ V \le V_{out}\ ^{1)} \le V_S$ $(V_S - 1.5\ V) \le V_{out} \le V_S$ at $I_{out}{}^{2)} \le 100\ mA$

[1] Output voltage.
[2] Output current.

i **NOTE**
Assign the functions for the external digital outputs in the device using a configuration tool, e.g., the SOPAS ET configuration software.

14.6 Connection diagrams of connection module CDM420-0006

i **NOTE**
An adapter cable is required to connect the device to the CDM420-0006 connection module. Configuration: Female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin

14.6.1 Connection of the device to CDM420-0006
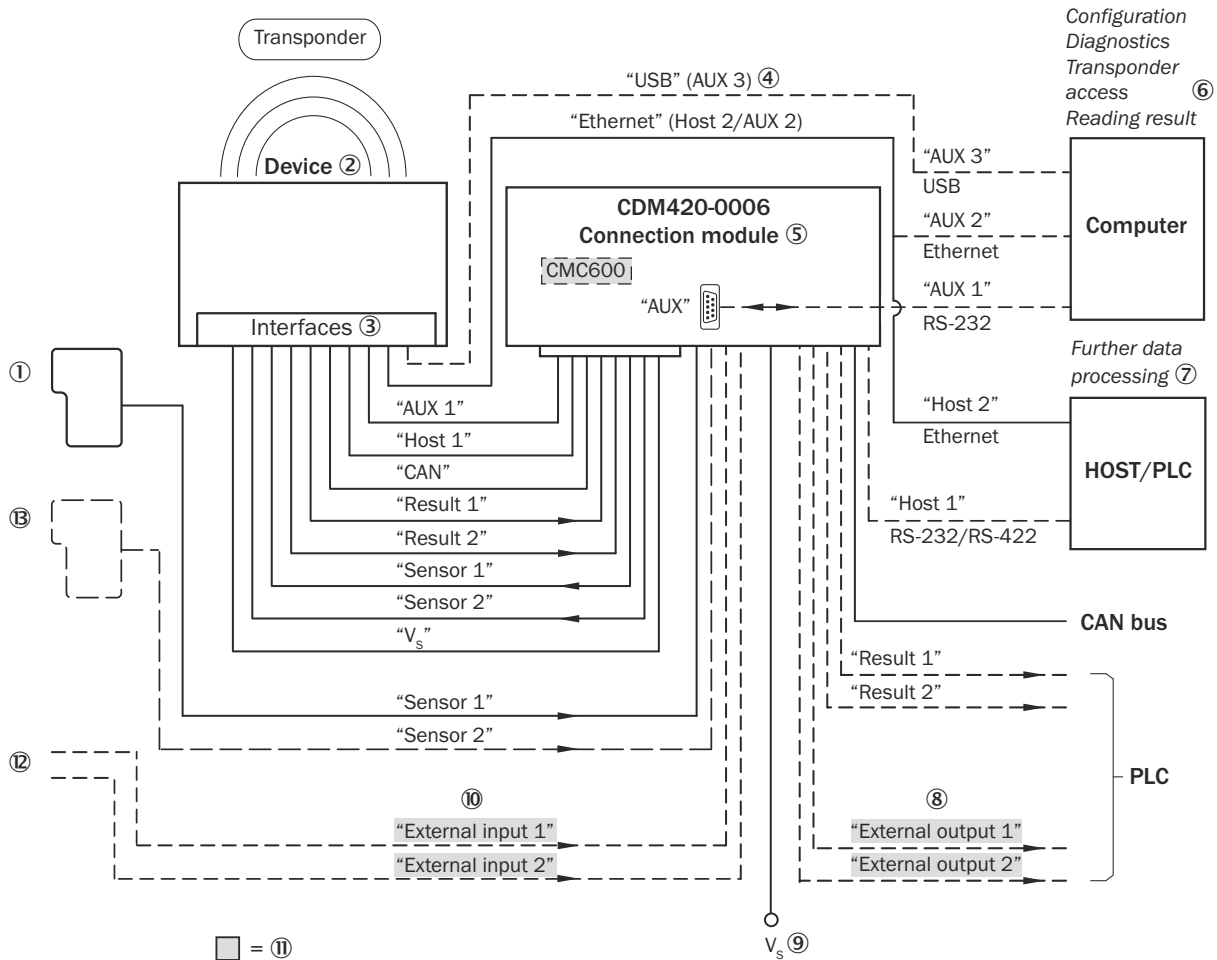
Device = RFU650-101xx

Figure 48: Connection of the device to peripherals via CDM420-0006 (overview)

①   External trigger sensor, e.g. for read cycle generation
②   Device
③   Interfaces
④   USB interface, for temporary use as a servicing interface only
⑤   Connection modules
⑥   Configuration, diagnostics, transponder access or display of read result
⑦   Data further processing
⑧   External digital outputs (switching)
⑨   Supply voltage V_S
⑩   External digital inputs (switching)
⑪   The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device (highlighted in gray).
⑫   Other functions
⑬   Application-dependent alternative stop reading cycle (e.g. photoelectric sensor) or travel increment (incremental encoder)

14.6.2   Wiring overview of the CDM420-0006
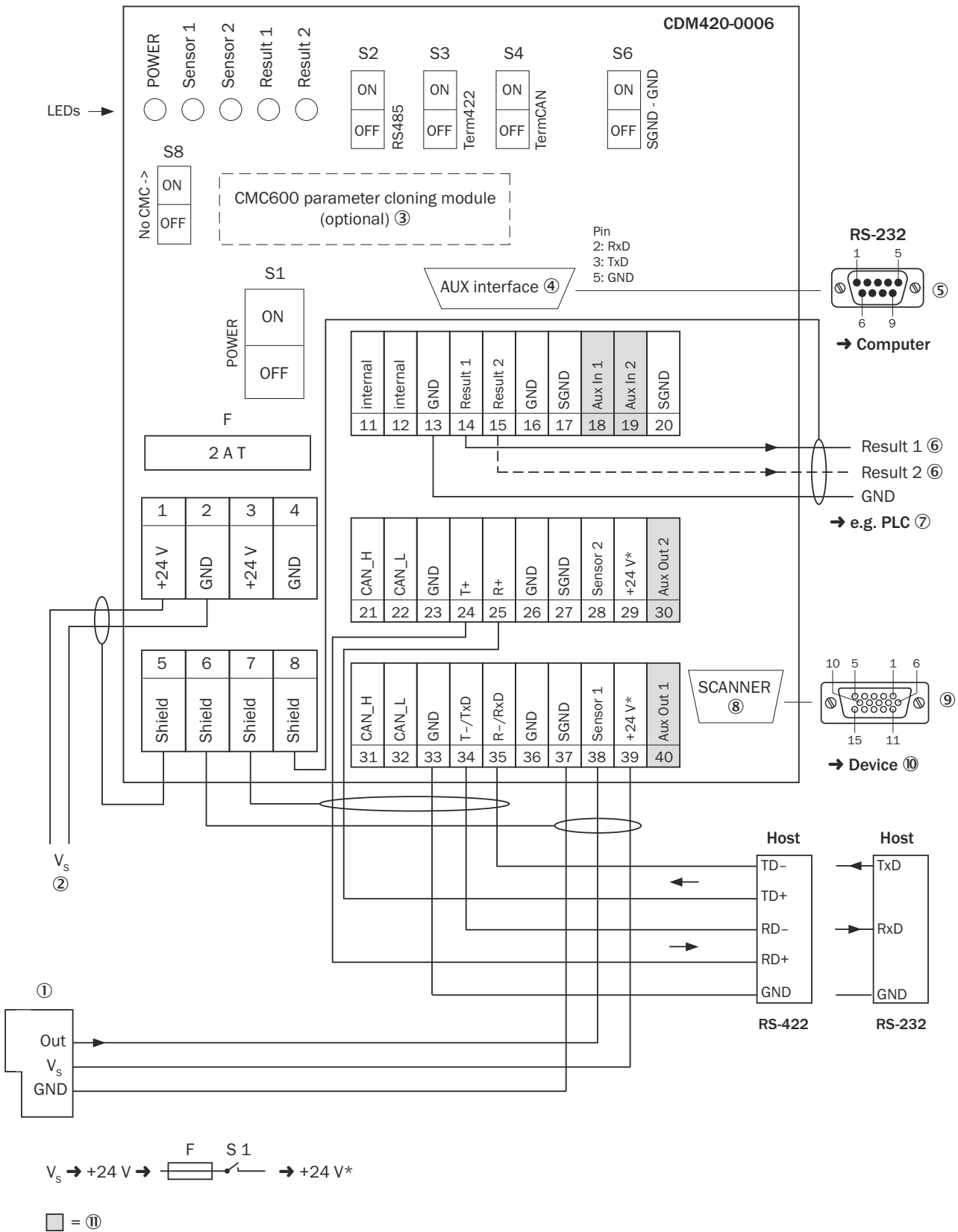
Device = RFU650-101xx, 1 digital input used

Figure 49: Overview: connection of device and peripherals to the CDM420-0006 connection module.

① External trigger sensor, e.g. for read cycle generation
② Supply voltage V_S

③   CMC600 parameter cloning module (optional)

④   Auxiliary interface "AUX"

⑤   Male connector, D-Sub, 9-pin

⑥   Name of the digital output

⑦   e.g. PLC (programmable logic controller)

⑧   SCANNER = Device

⑨   Female connector, D-Sub-HD, 15-pin

⑩   Device to be connected

⑪   The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device (highlighted in gray).

14.6.3   Connecting supply voltage for the device in CDM420-0006
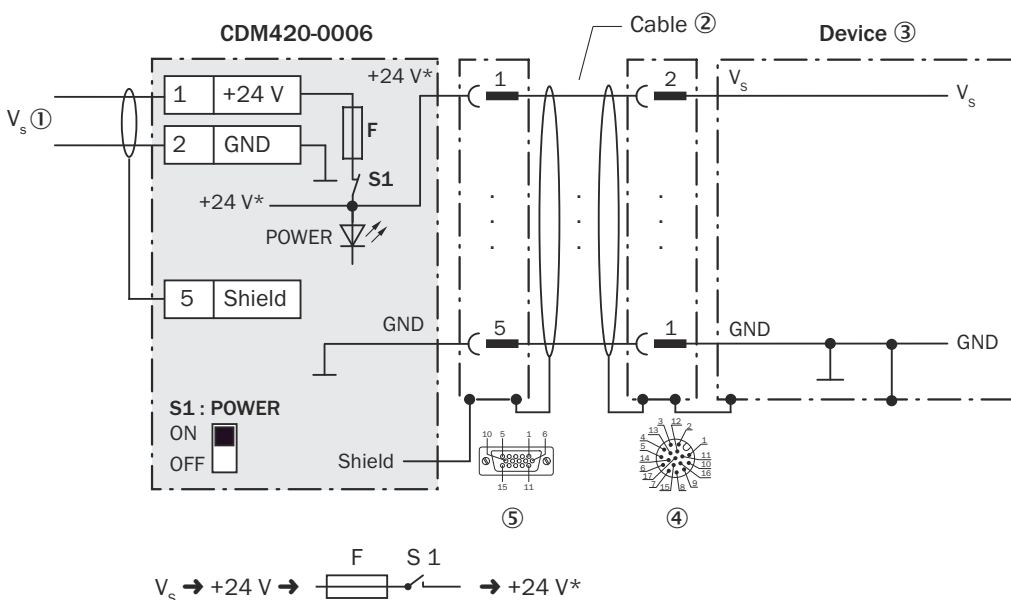
Device = RFU650-101xx

Figure 50: Connecting supply voltage for the device in CDM420-0006 connection module.

①   Supply voltage V_S

②   Adapter cable with male connector, D-Sub-HD, 15-pin and female connector, M12, 17-pin, A-coded

③   Device

④   Device: male connector, M12, 17-pin, A-coded

⑤   Connection module: female connector, D-Sub-HD, 15-pin

Function of switch S1

Table 42: Switch S1: Power

Switch setting	Function
ON	Supply voltage +24 V connected to CDM420-0006 and device via fuse as +24 V* supply voltage Supply voltage +24 V* can be additionally tapped at terminals 29 and 39
OFF	CDM420-0006 and device disconnected from supply voltage Recommended setting for all connection work

14.6.4 Wiring serial host interface RS-232 of the device in the CDM420-0006

Device = RFU650-101xx

Figure 51: Wiring data interface RS-232 of the device in connection module CDM420-0006.

① Device
② Adapter cable with male connector, D-Sub-HD, 15-pin and female connector, M12, 17-pin, A-coded
③ Connection module: female connector, D-Sub-HD, 15-pin
④ Device: male connector, M12, 17-pin, A-coded

> **NOTE**
> Activate the RS-232 data interface in the device with a configuration tool, e.g., the configuration software SOPAS ET.

14.6.5 Wiring serial host interface RS-422 of the device in the CDM420-0006
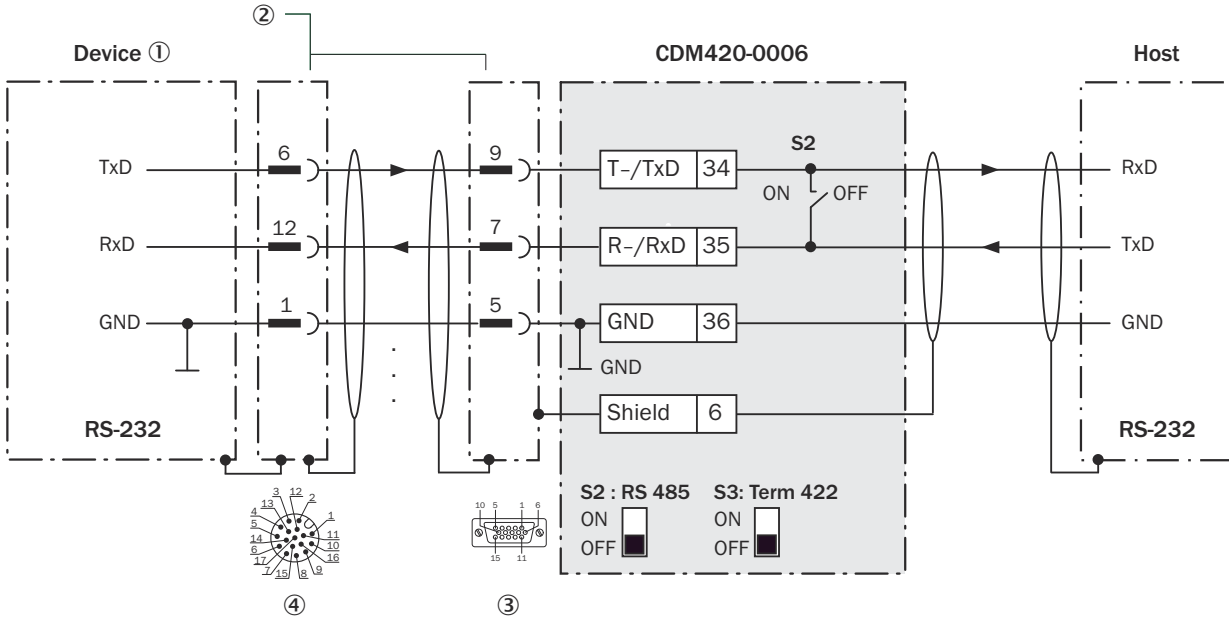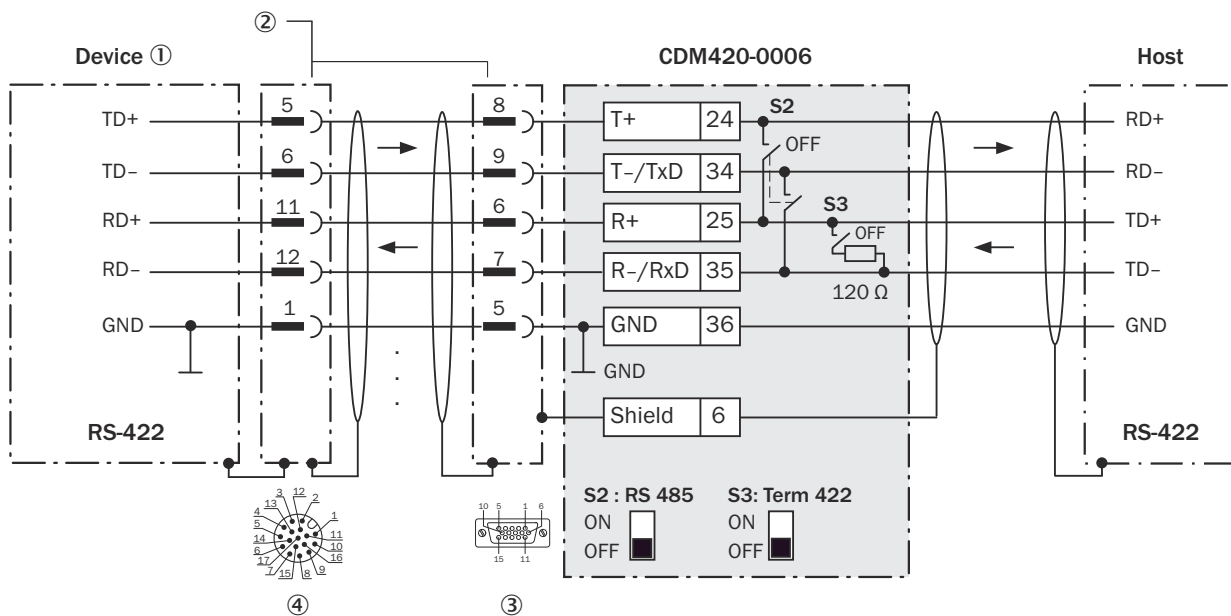
Device = RFU650-101xx

Figure 52: Wiring data interface RS-422 of the device in connection module CDM420-0006.

①   Device
②   Adapter cable with male connector, D-Sub-HD, 15-pin and female connector, M12, 17-pin, A-coded
③   Connection module: female connector, D-Sub-HD, 15-pin
④   Device: male connector, M12, 17-pin, A-coded

Function of switch S3

Table 43: Switch S3: Term 422

Switch setting	Function
ON	Terminates the RS-422 receiver in the device to improve the noise ratio on the line
OFF	No termination

> **i** **NOTE**
> Activate the RS-422 data interface ("Point-to-Point" option) in the device with a configuration tool, e.g. the configuration software SOPAS ET.

The requirements and restrictions apply when using the RS-422 data interface:
- RS-422 operation only 4-wire with ground
- The relevant interface drivers for the device comply with the standard in accordance with RS-422.

14.6.6   Wiring the CAN interface of the device in the CDM420-0006
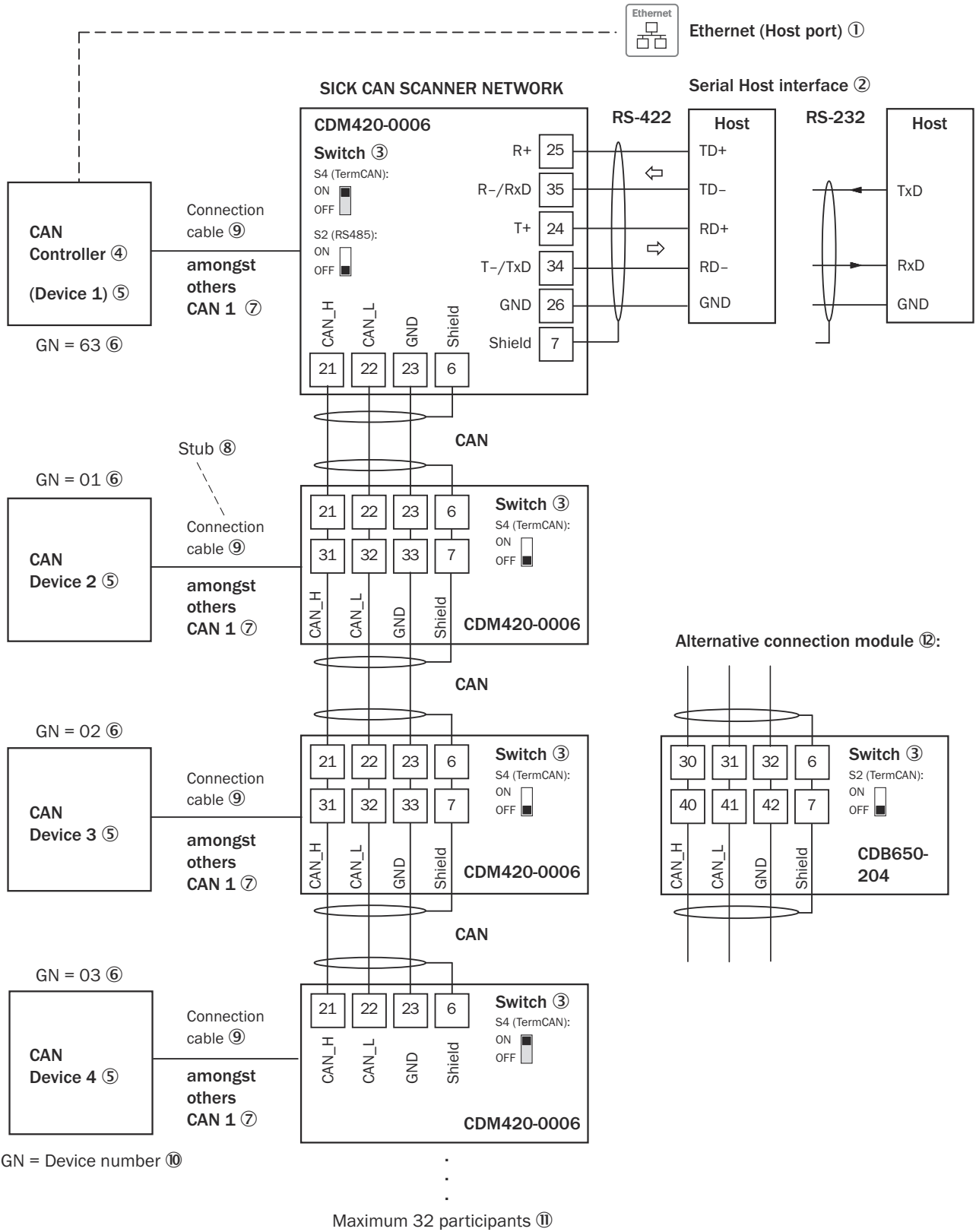
Device = RFU650-101xx

Figure 53: Wire the CAN interface of the device in the CDM420-0006 connection module. Connection and looping through of the supply voltage and connection of a trigger sensor for read cycle generation at the CAN controller, for example, are disregarded here.

① Ethernet (host port)

②	Serial host interface
③	Switch
④	CAN controller
⑤	CAN device
⑥	Device number
⑦	CAN etc.
⑧	Branch line
⑨	Adapter cable with female connector, M12, 17-pin, A-coded and male connector, D-Sub-HD, 15-pin
⑩	Device number (GN)
⑪	Maximum 32 users
⑫	Alternative connection module CDB650-204

A connection cable 1:1 with female connector, M12, 17-pin, A-coded and male connector, M12, 17-pin, A-coded is required to connect the device.

> **NOTE**
>
> Activate the CAN data interface in the device with a configuration tool, e.g., the configuration software SOPAS ET.
>
> Make further settings in the device corresponding to the function of the device in the system configuration.

14.6.7 Wiring digital inputs of the device in the CDM420-0006

Device = RFU650-101xx

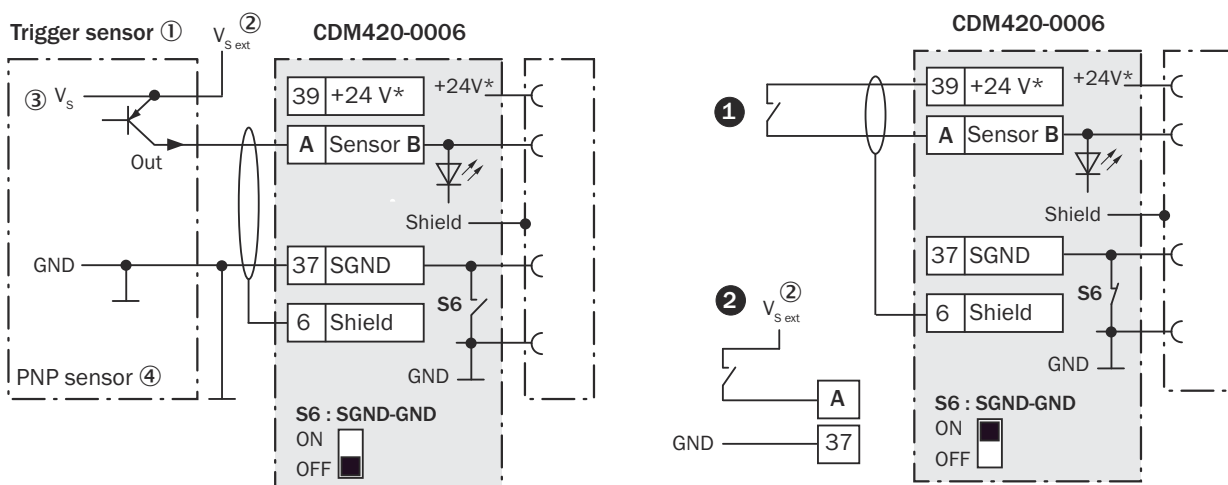| ①	Trigger sensor, e.g. for read cycle generation
②	Adapter cable with male connector, D-Sub-HD, 15-pin and female connector, M12, 17-pin, A-coded
③	Input voltage V_{in}
④	Device
⑤	Device: male connector, M12, 17-pin, A-coded
⑥	Connection module: female connector, M12, 17-pin, A-coded
⑦	E.g. photoelectric sensor
⑧	PNP sensor
⑨	Supply voltage V_S

Figure 54: Left: Trigger sensor connected potential-free and supplied with power externally. Right: Alternatively switch, ❶ supplied with power by connection module CDM420-0006 or ❷ connected potential-free and supplied with power externally. Now select switch setting S6 as shown in the left figure.

①   Trigger sensor, e.g. for read cycle generation

②   External supply voltage $V_{S\,ext}$

③   Supply voltage V_S

④   PNP sensor

Table 44: Assignment of placeholders to the digital inputs

CDM420-0006			Device	
Terminal A	**Signal B**	**Pin C**	**Pin D**	**Sensor E**
38	Sensor 1	14	10	1
28	Sensor 2	4	15	2

Function of switch S6

Table 45: Switch S6: SGND - GND

Switch setting	Function
ON	GND of the trigger sensor is connected with GND of CDM420-0006 and GND of the device
OFF	Trigger sensor is connected volt-free at CDM420-0006 and the device. Common, isolated reference potential of all digital inputs is SGND.

Characteristic data of the digital inputs

Table 46: Characteristic data of the digital inputs "Sensor 1" and "Sensor 2"

Type	Switching
Switching behavior	Power to the input starts the assigned function, e.g. start read cycle. Default setting in the device: logic not inverted (active high), debounce time 10 ms
Properties	• Opto-decoupled, reverse polarity protected • Can be wired with PNP output of a trigger sensor
Electrical values	Low: V_{in}[1] ≤ 2 V; I_{in}[2] ≤ 0.3 mA High: 6 V ≤ V_{in} ≤ 30 V; 0.7 mA ≤ I_{in} ≤ 5 mA

[1]   Input Voltage
[2]   Input current

14.6.8   Wiring the external digital inputs of the device in the CDM420-0006
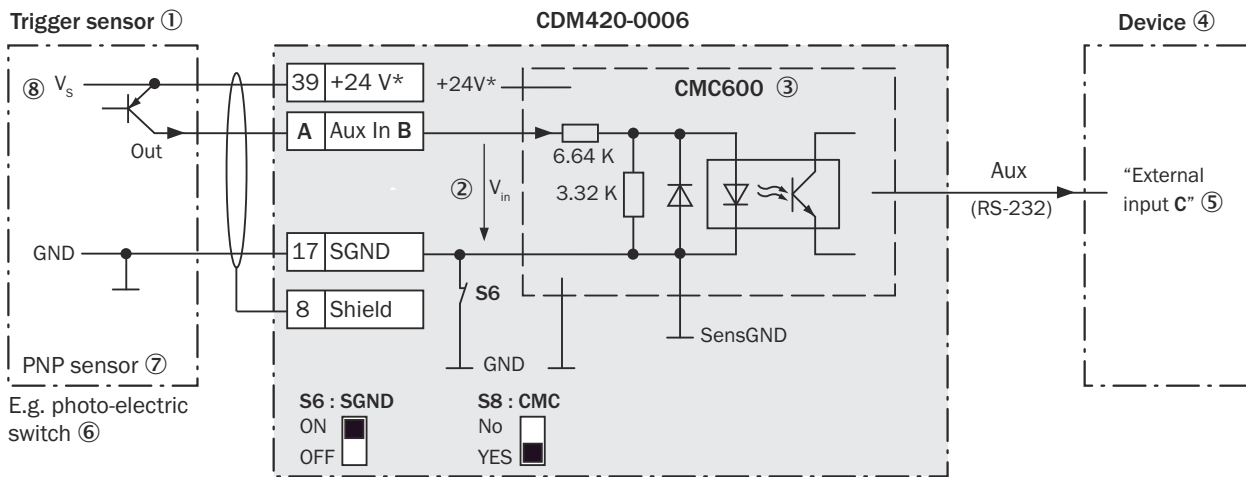
Device = RFU650-101xx

Figure 55: Trigger sensor supplied with power by connection module CDM420-0006

①　　　Trigger sensor, e.g. for read cycle generation
②　　　Input voltage V_{in}
③　　　The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device.
④　　　Device
⑤　　　Logical "External input" in the device
⑥　　　e.g. photoelectric sensor
⑦　　　PNP sensor
⑧　　　Supply voltage V_S
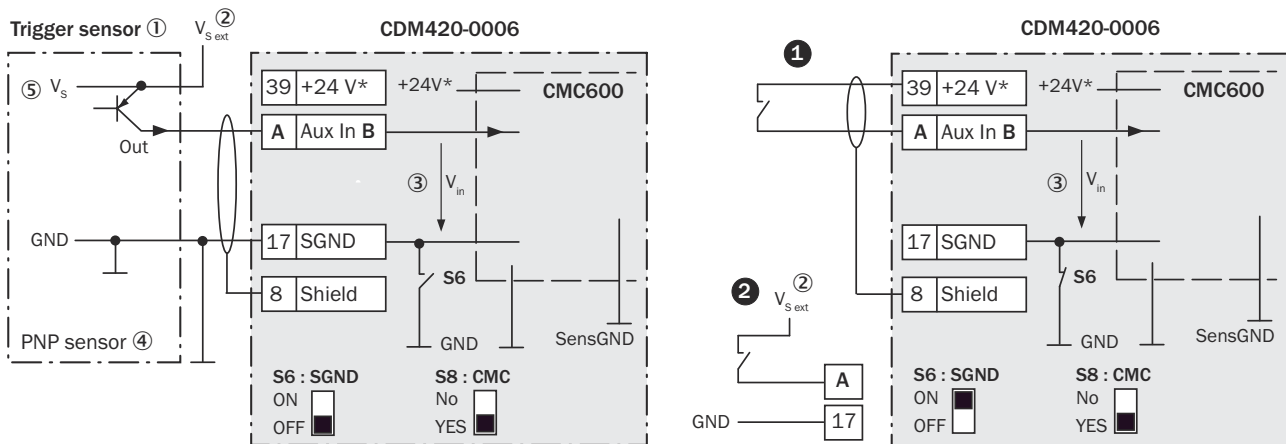
Figure 56: Left: Trigger sensor connected potential-free and supplied with power externally. Right: Alternatively switch, ❶ supplied with power by connection module CDM420-0006 or ❷ connected potential-free and supplied with power externally. Switch setting S3 then as in left figure.

①　　　Trigger sensor, e.g. for read cycle generation
②　　　External supply voltage $V_{S\,ext}$
③　　　Input voltage V_{in}
④　　　PNP sensor
⑤　　　Supply voltage V_S

Table 47: Assignment of placeholders to the digital inputs

CDM420-0006		Device
Terminal A	**Signal B**	**External input C**
18	Aux In 1	1
19	Aux In 2	2

Function of switch S6

Table 48: Switch S6: SGND - GND

Switch setting	Function
ON	GND of the trigger sensor connected with GND of CDM420-0006 and CMC600
OFF	Trigger sensor connected volt-free at CDM420-0006 and CMC600 Common, isolated reference potential of all digital inputs is SGND.

Functional principle of the external digital inputs

The optional CMC600 parameter cloning module in combination with the CDB or CDM connection module offers two additional physical digital inputs for the device. The inputs are available at the respective terminals of the connection module. To distinguish them from the physical digital inputs directly on the device, these addition inputs via the CMC600 are designated as "external inputs".

ℹ **NOTE**
The CMC600 transmits the switching signals of the external digital inputs as statuses to the local inputs of the device via its serial data interface.
The digital inputs are not suitable for time-critical applications.

ℹ **NOTE**
The transmission of the input signals on the CMC600 to the device may be delayed by up to 15 ms.

Characteristic data of the digital inputs

Table 49: Characteristic data of the digital inputs "External input 1" and "External input 2"

Type	Switching
Switching behavior	Power to the input starts the assigned function, e.g. start read cycle. Default setting in the device: logic not inverted (active high), debounce time 10 ms
Properties	• Opto-decoupled, reverse polarity protected • Can be wired with PNP output of a trigger sensor
Electrical values	Low: V_{in}[1] $\leq$ 2 V; I_{in}[2] $\leq$ 0.3 mA High: 6 V $\leq V_{in} \leq$ 30 V; 0.7 mA $\leq I_{in} \leq$ 5 mA

[1] Input voltage.
[2] Input current.

ℹ **NOTE**
Assign the functions for the digital inputs in the device using a configuration tool, e.g., the configuration software SOPAS ET.

14.6.9 Wiring digital outputs of the device in the CDM420-0006
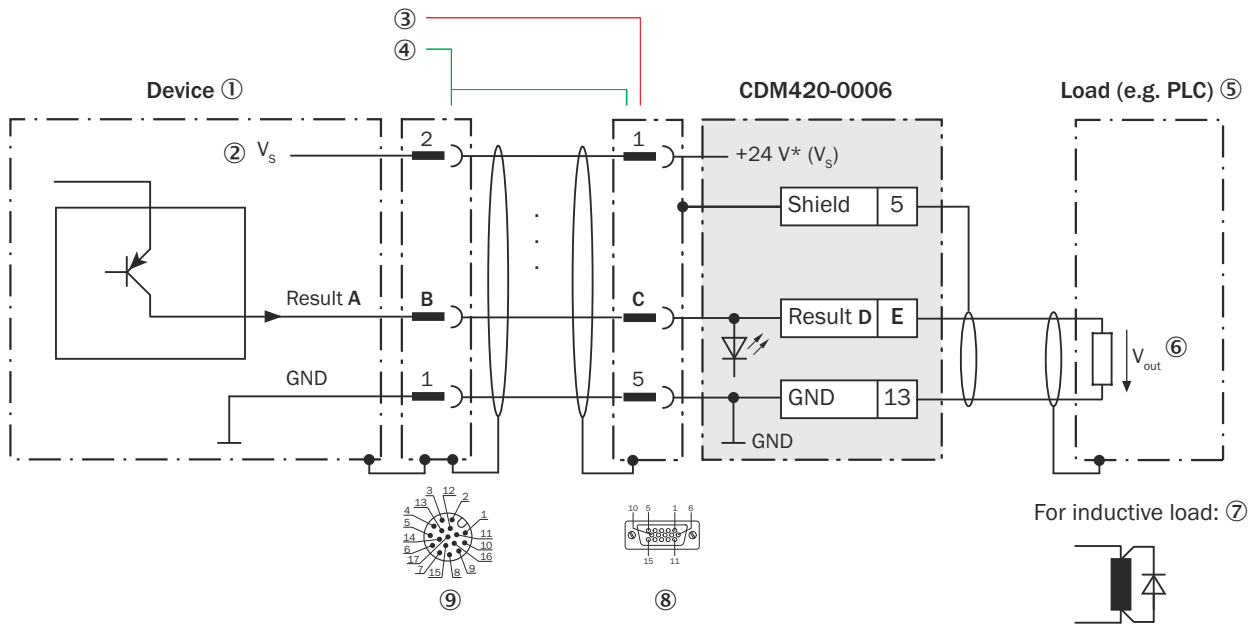
Device = RFU650-101xx

Figure 57: Wiring the "Result 1" and "Result 2" digital outputs of the device in the CDM420-0006 connection module.

Inductive load

> **NOTE**
>
> Provide an arc-suppression switch at the digital output if inductive load is present.
>
> ▶ Attach a freewheeling diode directly to the load for this purpose.

Table 50: Assignment of placeholders to the digital outputs

Device		CDM420-0006		
Output A	Pin B	Pin C	Signal D	Terminal E
Result 1	13	12	Result 1	14
Result 2	14	13	Result 2	15

Characteristic data of the digital outputs

Table 51: Characteristic data of the "Result 1" and "Result 2" digital outputs

Type	Switching
Switching behavior	PNP switching to supply voltage V_S Default settings in the device: no function, logic: not inverted (active high)
Properties	• Short-circuit protected and temperature protected • Not electrically isolated from the supply voltage V_S
Electrical values	$0\ V \leq V_{out}^{1)} \leq V_S$ $(V_S - 1.5\ V) \leq V_{out} \leq V_S$ at $I_{out}^{2)} \leq 100\ mA$

1) Output voltage.
2) Output current.

> **NOTE**
>
> Assign the functions for the digital outputs in the device using a configuration tool, e.g., the configuration software SOPAS ET.

14.6.10   Wiring the external digital outputs of the device in the CDM420-0006
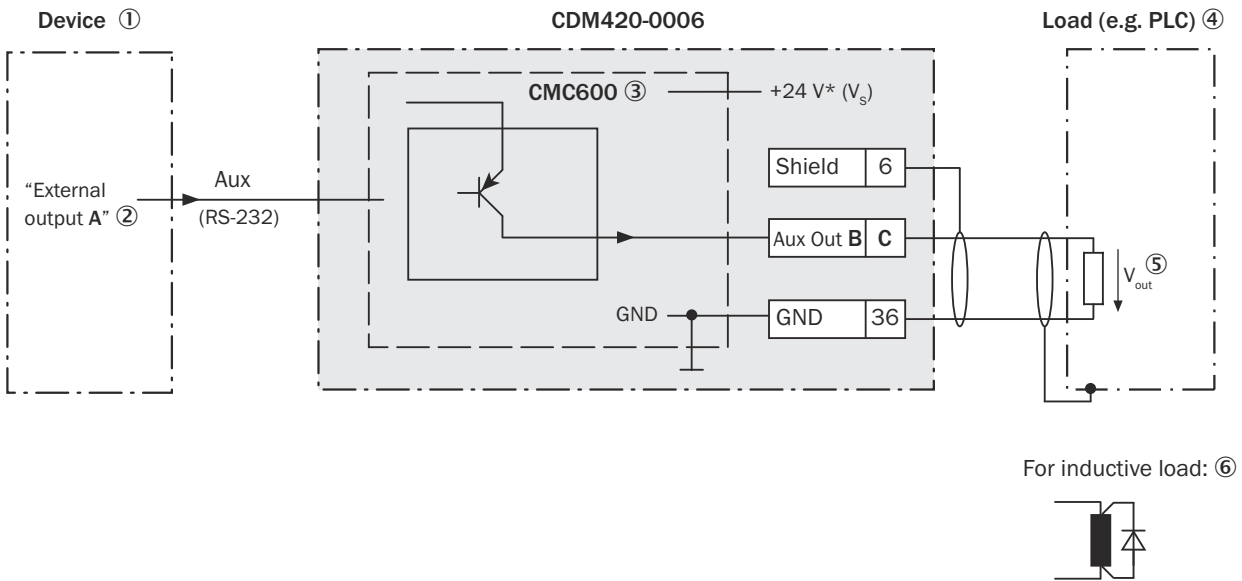
Device = RFU650-101xx

Figure 58: Wiring "Aux Out 1" and "Aux Out 2" external digital outputs of the device in the connection module CDM420-0006.

①   Device
②   Logical "External output" in the device
③   The optional CMC600 parameter cloning module is required in the connection module in order to use the additional external digital inputs and outputs of the device.
④   Load (e.g. PLC)
⑤   Output voltage V_{out}
⑥   With inductive load: see note

Inductive load

> ℹ️ **NOTE**
> Provide an arc-suppression switch at the digital output if inductive load is present.
>
> ▶   Attach a freewheeling diode directly to the load for this purpose.

Table 52: Assignment of placeholders to the external digital outputs

Device	CDM420-0006	
External output A	**Signal B**	**Terminal C**
1	Aux Out 1	40
2	Aux Out 2	30

Functional principle of the external digital outputs

Characteristic data of the digital outputs

Table 53: Characteristic data of the digital outputs "External output 1" and "External output 2"

Type	Switching
Switching behavior	PNP switching to supply voltage V_S Default settings in the device: no function, logic: not inverted (active high)
Properties	• Short-circuit protected and temperature protected • Not electrically isolated from V_S
Electrical values	$0\ V \le V_{out}^{1)} \le V_S$ $(V_S - 1.5\ V) \le V_{out} \le V_S$ at $I_{out}^{2)} \le 100$ mA

[1] Output voltage.
[2] Output current.

> **i** **NOTE**
> Assign the functions for the digital outputs in the device using a configuration tool, e.g., the configuration software SOPAS ET.

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14.8 Abbreviations used

General

CAN	**C**ontrolled **A**rea **N**etwork. Field bus protocol based on the CAN bus
CDB	**C**onnection **D**evice **B**asic
CDF	**C**onnection **D**evice **F**ieldbus
CDM	**C**onnection **D**evice **M**odular
CE	**C**ommunauté **E**uropéenne. European Community
CMC	**C**onnection **M**odule **C**loning
CMF	**C**onnection **M**odule **F**ieldbus
CMP	**C**onnection **M**odule **P**ower
CoLa-A	**C**ommand **L**anguage **A**SCII (SICK-specific protocol)
CSN	**C**AN **S**ensor **N**etwork (SICK-specific protocol)

DNS	**D**omain **N**ame **S**erver
ESD	**E**lectro-**S**tatic-**D**ischarge. Electrostatic discharge
ETSI	**E**uropean **T**elecommunications **S**tandards **I**nstitute
EMC	**E**lectro**m**agnetic **C**ompatibility
ERP	**E**ffective **R**adiated **P**ower. Effective radiant power
EIRP	**E**quivalent **I**sotropic **R**adiated **P**ower. Equivalent isotropic radiated power
FCC	**F**ederal **C**ommunications **C**ommission
GSD	**G**eneral **S**tation **D**escription (Generic station description for PROFIBUS/ PROFINET)
HTML	**H**yper **T**ext **M**arkup **L**anguage (Page description language used in the Internet)
I	**I**nput (Input)
I_{in}	Input current
I_{out}	Output current
LED	**L**ight **E**mitting **D**iode. Light-emitting diode
LPS	**L**imited **P**ower **S**upply
MAC	**M**edium **A**ccess **C**ontrol
MTBF	**M**ean **T**ime **B**etween **F**ailures
MTTF	**M**ean **T**ime **T**o **F**ailure
MTTR	**M**ean **T**ime **T**o **R**epair
O	**O**utput
PDF	**P**ortable **D**ocument **F**ormat
RHCP	**R**ight **h**and **c**ircular **p**olarized. Right-hand circularly polarized
RFID	**R**adio **F**requency **Id**entification
RTF	**R**ich **T**ext **F**ormat (Standard document format with format descriptions)
RFU	**R**adio **F**requency **U**ltra high frequency
SD	**S**ecure **D**igital
SOPAS ET	**S**ICK **O**pen **P**ortal for **A**pplication and **S**ystems **E**ngeneering **T**ool. SICK software for computer (Windows) for device configuration.
SDD	**S**OPAS **D**evice **D**escription (Device description file, driver for SICK SOPAS ET software)
PLC	**P**rogrammable **L**ogic **C**ontroller
TCP/IP	**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol
TID	**T**ag **Id**entifier (Transponder Identification Number. Unique, unchangeable number from the IC manufacturer.
UHF	**U**ltra**h**igh**f**requency
UII	**U**nique **I**tem **I**dentifier. Used to identify the transponder (can be changed individually).
UL	**U**nderwriters **L**aboratories
USB	**U**niversal **S**erial **B**us
VESA	**V**ideo **E**lectronics **S**tandards **A**ssociation
V_{in}	Input Voltage
V_{out}	Output voltage
V_S	Supply voltage
$V_{S\ ext}$	External supply voltage

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